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FUEL GRADE ETHANOL PRODUCTION USING WOOD WASTE (RESIDUES) AT SELECTED SITES IN MONTANA

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FUEL GRADE ETHANOL PRODUCTION USING WOOD WASTE (RESIDUES) AT SELECTED SITES IN MONTANA

Prepared by

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June 1985

Prepared for

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DNRC 85-271
AMENDMENT NO. 5

FUEL GRADE ETHANOL PRODUCTION USING WOOD WASTE (RESIDUES) AT SELECTED SITES IN MONTANA

FEASIBILITY STUDY - FINAL REPORT
VOLUME III: PLANT DESIGN AND COSTS

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JUNE 1985

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1.0 PLANT DESIGN AND COSTS

1.1 INTRODUCTION

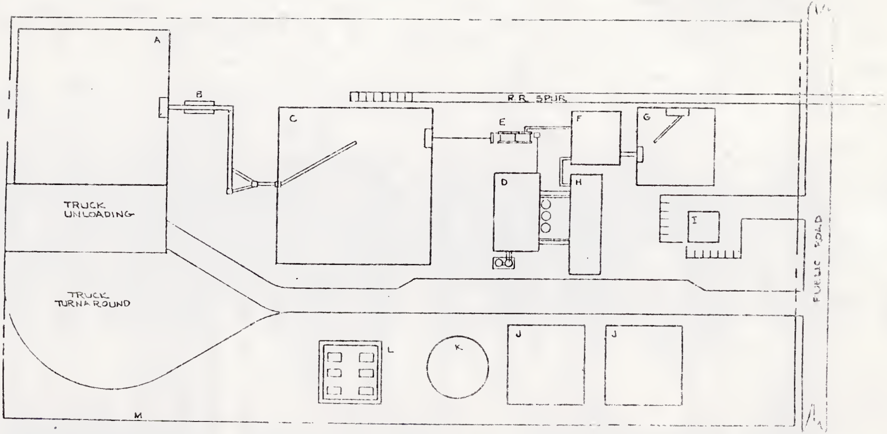
The Milestone No. 3 Report was prepared with the objective of compiling and estimating the economic factors (non-site-specific) of ethanol from wood for the following capacities:

a) 2.5 million gpy ethanol/year;
b) 1.25 million gpy ethanol/year;
c) 0.775 million gpy ethanol/year; and
d) 0.2 million gpy ethanol/year.

1.2 DESCRIPTION OF MODIFIED MADISON WOOD PROCESS

1.2.1 Process Flowsheets and Material Balance

The plant process is described schematically in the flowsheets of Figures 1-1 through 1-10, inclusively. Plant section designations used in the process descriptions below are those presented in the referenced drawings. The process material balances are presented in the sequence of Figures 1-11 through 1-14 (pages 1-20 through 1-23) which contain the major quantitative inputs, throughputs, and outputs of the plant system.



	SCHEDULE	SIZE
A	WOOD WASTE STORAGE	200' X 200'
B	CLEANING POND	20' X 40'
C	PROCESS WOOD STORAGE	200' X 200'
D	HYDROL & NEU BLDG	100' X 60
E	STEAM PRETREATMENT	30' X 40'
F	BOILER BLDG	56' X 70'
G	COAL STORAGE	100' X 100'
H	FERMENTATION & DISTILLATION	40' X 130'
I	ADMIN BUILDING	40' X 40'

	SCHEDULE	SIZE
J	SETTLING PONDS (2)	100' X 100' EACH
K	CLARIFIER	80' DIA.
L	TANK FARM	80' X 80'
M	LAND DIMENSIONS	1000' X 500' (11.5 Ac)

Fuel Ethanol Production From Wood Waste

SCALE: NONE
DATE 11/81
APPROVED BY JHW
DRAWN BY MCS
REVISED

TYPICAL SITE PLAN

MULTITECH INC BUTTE MT
DRAWING NUMBER 24-000-100-B

FIGURE 1-1.--TYPICAL SITE PLAN

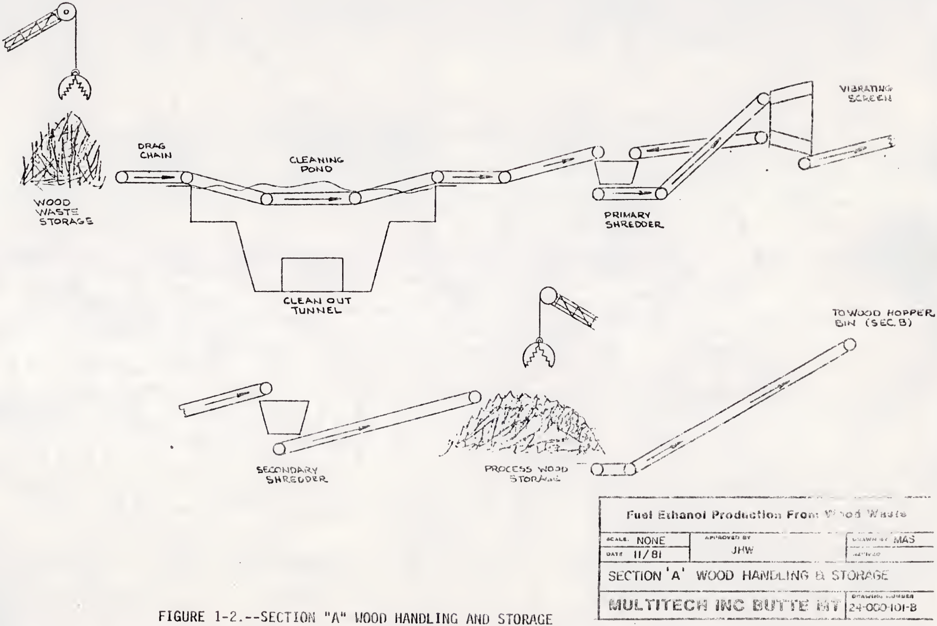


FIGURE 1-2.--SECTION "A" WOOD HANDLING AND STORAGE

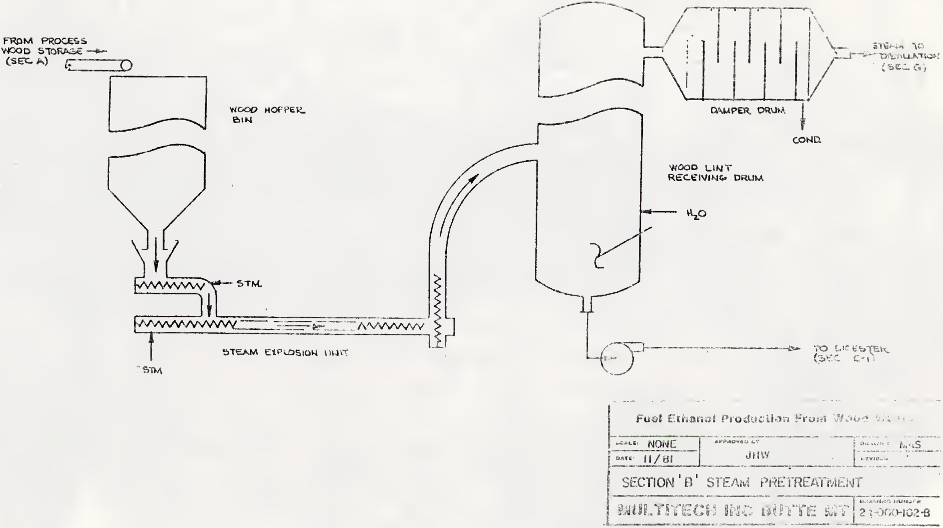


FIGURE 1-3.--SECTION "B" STEAM PRETREATMENT

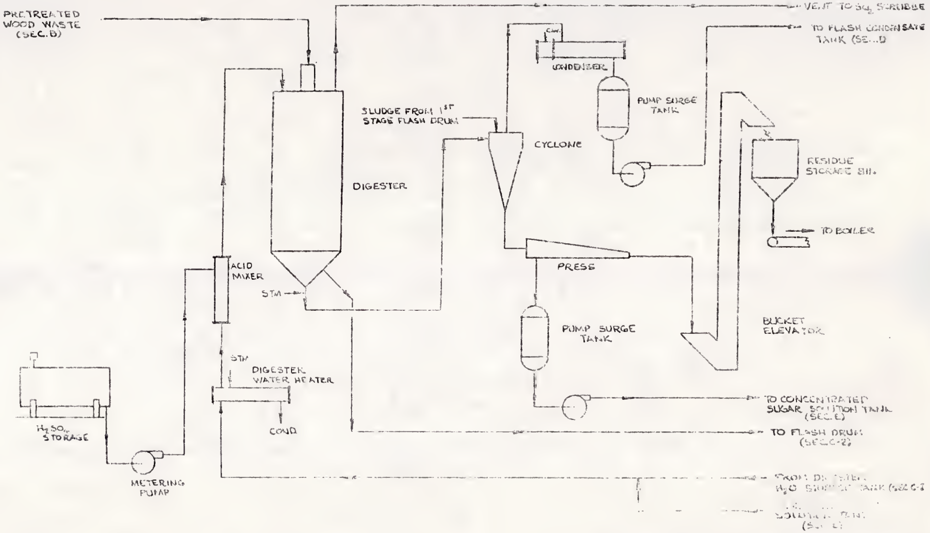


FIGURE 1-4.--SECTION "C-1" DIGESTION

Fuel Ethanol Production From Wood Waste

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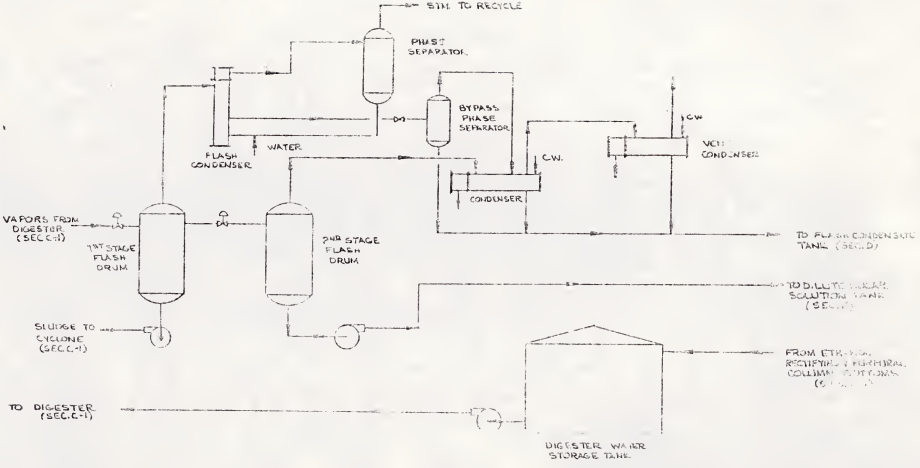
SECTION 'C-1' - DIGESTION

MULTITECH INC BUTTE MT	DRAWING NUMBER 23-000-105-B


STM. TO RECYCLE
PHASE SEPARATOR
BYPASS PHASE SEPARATOR
C.W.
VENT CONDENSER
FLASH CONDENSER
WATER
C.W.
CONDENSER
VAPORS FROM DIGESTER (SEC C-1)
1ST STAGE FLASH DRUM
2ND STAGE FLASH DRUM
TO FLASH CONDENSATE TANK (SEC. D)
TO DILUTE SUGAR SOLUTION TANK (SEC.)
SLUDGE TO CYCLONE (SEC. C-1)
FROM ETHANOL RECTIFYING & FURFURAL COLUMN BOTTOMS
TO DIGESTER (SEC. C-1)
DIGESTER WATER STORAGE TANK

Fuel Ethanol Production From Wood Waste		
SCALE NONE DATE 11/81	APPROVED BY JHW	DRAWN BY MAS
SECTION 'C-2' - DIGESTION		
MULTITECH INC BUTTE MT		DRAWING NUMBER 24-000-104-B

FIGURE 1-5.--SECTION "C-2" DIGESTION

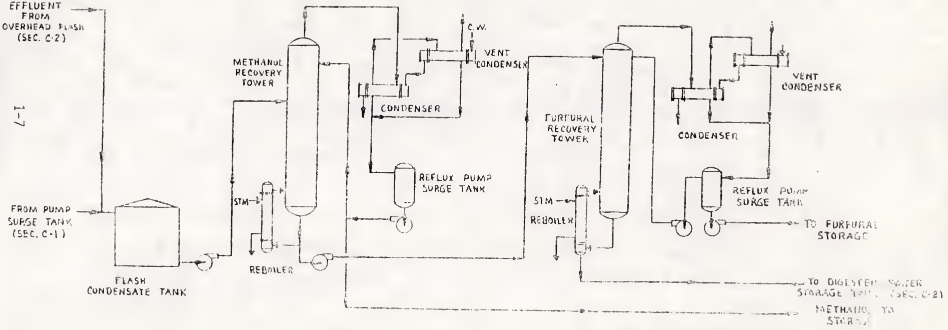


FIGURE 1-6.--SECTION "D" CHEMICAL BYPRODUCTS

Fuel Ethanol Production From W

SCALE NONE	APPROVED BY JW	DRAWN BY MPS
DATE 11/81		

SECTION 'D' - CHEMICAL BYPRODUCTS

MULTITECH INC BUTTE MT

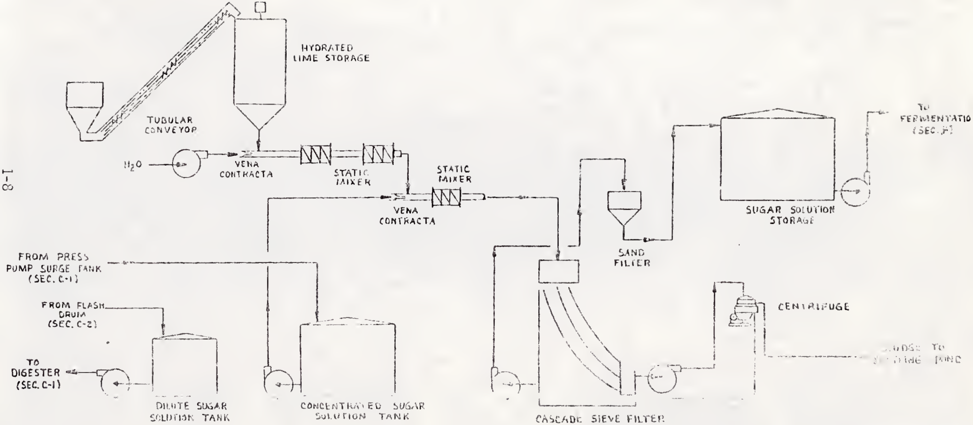


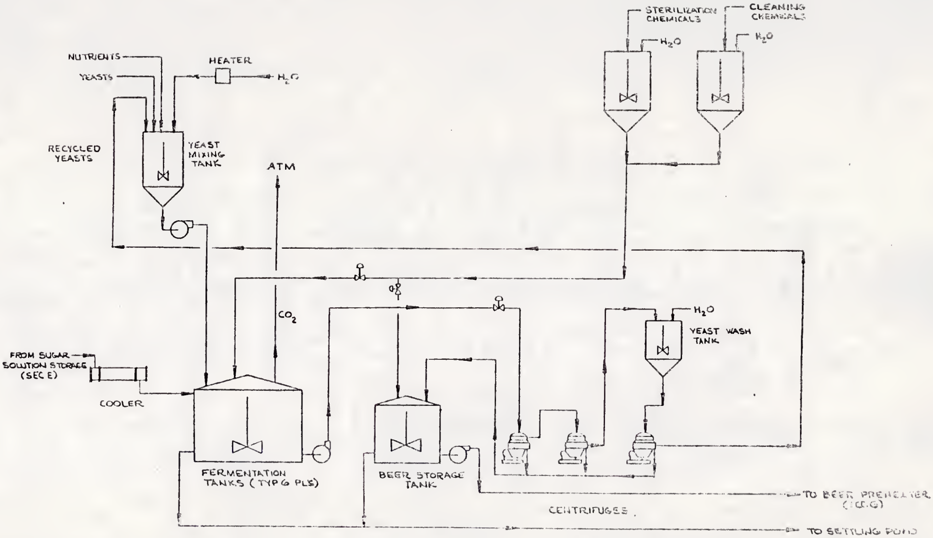
FIGURE 1-7 --SECTION "E" NEUTRALIZATION

Fuel Ethanol Production From Wood Waste

SCALE: NONE
DATE: 11/81
APPROVED BY: JW
DRAWN BY: MAS

SECTION 'E' - NEUTRALIZATION

[illegible]



Fuel Ethanol Production From Wood Waste		
SCALE. NONE DATE 11/81	APPROVED BY JW	DRAWN BY MAS REVISED
SECTION 'F' - FERMENTATION		
MULTITECH INC BUTTE MT		DRAWING NUMBER 24-000-107-B

FIGURE 1-8 --SECTION "F" FERMENTATION

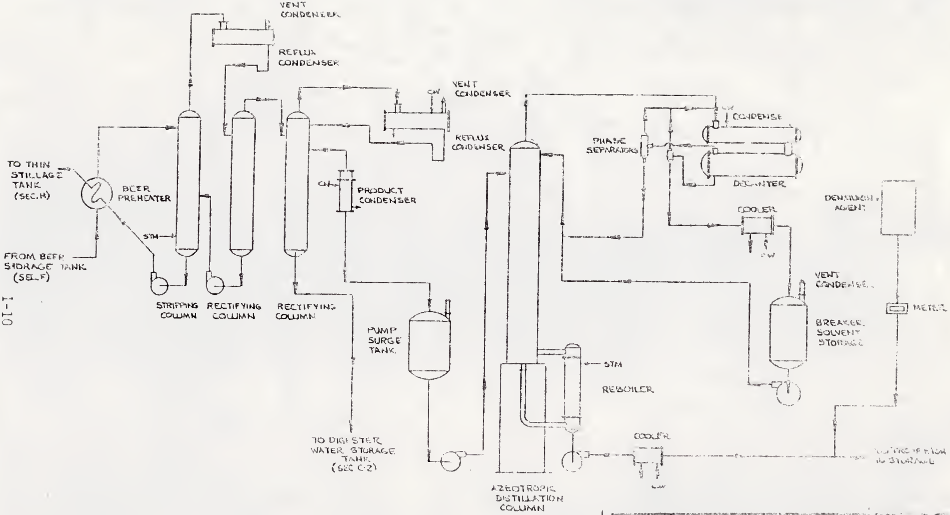


FIGURE 1-9.--SECTION "G" DISTILLATION

Fuel Ethanol Production From Wood Waste		
SCALE NONE DATE 11/81	APPROVED BY JW	DRAWN BY MAS REVISED
SECTION 'G' - DISTILLATION		
MULTITECH INC BUTTE MT		DRAWING NUMBER 24-000408-B

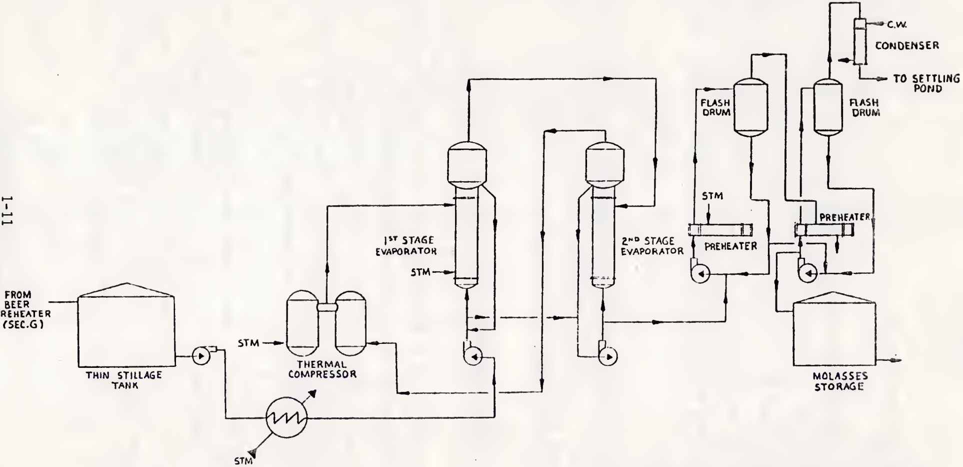


FIGURE 1-10.--SECTION "H" SUGAR BYPRODUCT RECOVERY

Fuel Ethanol Production From Wood Waste

SCALE: NONE	APPROVED BY:	DRAWN BY MAS
DATE: 11/81	JW	REVISED

SECTION 'H' SUGAR BYPRODUCT RECOVERY

MULTITECH INC BUTTE MT DRAWING NUMBER 24-000-109-B

1.2.2 Wood Waste Receiving, Handling, and Storage

Raw wood waste is trucked from the forest site to the ethanol plant in semi-trailers provided with drop-sides, which are unloaded by portable overhead grapple equipment. The wood waste is stacked as outside storage on concrete pad "A" as shown in Figure 1-1. Wood waste handled in this manner proceeds through the cleaning and shredding steps of Plant Section A to processed wood storage.

Chipped wood waste is unloaded by tractor-mounted front-end loading equipment. Such loads are relayed by portable belt transfer directly to processed wood storage (Plant Section A of Figure 1-1).

1.2.3 Steam Pretreatment

Wood waste proceeds from processed wood storage via inclined belt conveyor to the wood hopper bin of Plant Section B (Figure 1-1). It is delivered continuously to the steam explosion unit where it is purged with saturated steam, compressed, and exploded intermittently into the wood lint receiving drum by instrument controlled quick-release ball valve fittings.

The wood lint receiving drum is provided with baffles in the upper section to effect particulate removal, excluding fine bark fragments and wood linters from the steam recovery system for the steam explosion unit. The baffled damper drum section of the wood lint receiving system serves the dual purposes of noise diminution and steam recovery. Steam from the damper drum is delivered to the distillation section (Plant Section G) as part of the steam supply for the stripping column.

Following steam explosion treatment (Plant Section 'B'), the wood lint is accumulated in the bottom section of the wood lint receiving drum. With water addition and agitation, the lint is converted to a slurry to maintain a pressure seal and to allow constant delivery of a reasonably consistent feedstock for downstream processing. This slurry is removed continuously by a positive displacement pump and delivered to digester tanks (Plant Section C-1) with delivery rate controlled to match filling cycles.

1.2.4 Wood Waste Digestion

Delivery of wood waste slurry and sulfuric acid solution to the digester (Plant Section C-1) takes place concurrently. The sulfuric acid solution is produced by blending concentrated acid from storage with recycle water from previous batches, pumped from the digester water storage tank and the dilute sugar solution tank. The sulfuric acid concentration varies during the digestion cycle, trending toward dilution with steam addition to maintain optimum temperature and pressure. Ultimate acid concentration reached during the digestion cycle is about 0.5%.

When the digester has been completely charged with wood waste slurry and sulfuric acid solution, additional water is delivered from the digester water storage tank via the digester water heater. Its temperature and steam additions during the cycle are regulated to produce digester operating conditions of about 375°F and 200 psig.

190°C

The hydrolysate steam is removed from the bottom section of the digester and proceeds through the flash drum recovery system of Plant Section C-2. The bottoms from the first stage flash drum (Section C-2) contain tars and oils resulting from resin substances in the original wood waste and various degradation products of hydrolysis and oxidation. This material is pumped to the cyclone sludge collection system of Plant Section C-1 for use as boiler fuel. The bottoms product of the second-stage flash drum is the dilute sugar solution and proceeds to storage in Plant Section E.

Overhead vapors from Section C-2, containing methanol and furfural, are condensed and routed to the flash condensate tank (Section D) for storage. Bottoms from the second stage flash drum, containing minor amounts of sugars, are pumped to the dilute sugar solution storage tank, Section E.

When hydrolysate removal has been completed, the solid residue remaining in the digester (Section C-1) contains the majority of the lignin present in the original feedstock. Pressure maintained in the digester tank is utilized to blow this residue to the cyclone in Section C-1. It proceeds through a dewatering press where its solids content is increased to approximately 65%, and through an elevator leg for storage and use as boiler fuel. Vapors recovered from the cyclone, containing methanol and furfural, are condensed and pumped to the flash condensate tank of Section D. Liquors obtained from the dewatering press are accumulated and pumped to the concentrated sugar solution tank, Section E.

1.2.5 Chemical Byproducts Recovery

The flash condensate tank of Section D, containing the pooled methanol and furfural-containing condensates from wood waste digestion (Sections C-1 and C-2), serves as the distillation feedstock reservoir for chemical byproduct recovery. The condensate is pumped to the methanol recovery tower, where the combination of a reboiler, reflux system, and condenser are controlled to deliver anhydrous methanol to storage.

The second-stage liquor, containing furfural-water azeotrope, is removed as the bottoms product from the methanol recovery tower and pumped for overhead entry into the furfural recovery tower. The azeotrope is distilled and condensed, and crude furfural is pumped to storage.

1.2.6 Neutralization

Fresh water is used to prepare a hydrated lime slurry for sugar solution neutralization in Section E. It enters the system by pump pressure through a vena contracta, creating sufficient suction to draw powdered hydrated lime into the water stream. The two components proceed through a two-stage static mixer system for continuous blending with the concentrated sugar solution downstream in similar static mixer equipment.

The neutralized sugar solution proceeds through a cascade sieve filter for calcium sulfate and sludge removal. It then passes through a polishing sand filter, for removal of fine particle sludges and calcium sulfate, and proceeds to storage. Solid residues from both filtration systems are removed by centrifuge and are pumped to a settling pond.

1.2.7 Fermentation

Sugar feedstock for the fermentation section (Section F) is pumped from the sugar solution storage tank of Section E. This solution is cooled and delivered to the six (6) fermentation tanks, with yeast inoculum added to the stream from the overhead yeast mixing tank prior to delivery. The solution is fermented for 36 hours with a Saccharomyces cerevisiae yeast strain, and pumped to the beer storage tank at the end of the fermentation cycle. A yeast cell cream is harvested continuously from the fermenter tanks by centrifuge, commencing at the end of each fermentation cycle. Fermenter effluents are centrifuged, with liquid fractions delivered to the beer storage tanks for subsequent distillation. The yeast cell cream passes to the yeast mixing tank to serve as inoculum for future fermentation batches.

A period of 12 hours is nominally provided for fermenter turnaround time, to allow pumping time for empty-and-fill operations and insertion of necessary cleaning cycles. The frequency of need to clean and sterilize fermenters and beer storage tanks will be determined, over a period of time and will be based on plant running history. Solutions resulting from cleaning, sterilization, and rinsing are pumped to a settling pond.

1.2.8 Distillation

Fermentation beer exits the beer storage tanks of Section F and proceeds through the beer preheater of Section G into the top of the stripping column. The beer preheater heat exchanger transfers heat from stripping and rectifying column bottoms to the incoming beer stream, thus maximizing the steam economy of the ethanol distillation system. Steam is introduced to the stripping column only. Overhead vapors are condensed in reflux condensers between stripping and rectifying columns, thereby controlling reflux rate in the stripping column and supplying stripping steam to the rectifier sections of the distillation process.

The second rectifying column delivers an alcohol vapor stream at or about the composition of the ethanol-water azeotrope, or about 190° proof ethanol. This stream is condensed by passage through the product condenser and proceeds to a pump surge tank which serves as the feedstock reservoir for azeotropic distillation.

The single azeotropic distillation column of Section G operates with pentane, hexane, or heptane as the breaker solvent or entrainer. The ethanol-water azeotropic solution enters the upper section of the azeotropic distillation column, where it is combined with incoming entrainer solvent. Under continuous distillation conditions, anhydrous ethanol (199° to 200° proof) is removed from the column bottom and pumped through a water-cooled plate cooler to product storage. Unleaded gasoline as denaturant is metered into the stream after cooling takes place. Overhead vapors from the azeotrope column contain the breaker solvent, water, and minute amounts of ethanol. These vapors are condensed and decanted to recover the breaker solvent and ethanol for recycle. Water separated in the decantation system is routed to a settling pond.

1.2.9 Sugar Byproduct Recovery

Still bottoms from the stripping column of Section G, containing pentose sugars obtained by acid hydrolysis of wood waste during digestion, are routed through the beer preheater to storage in the thin stillage tank of Section H. This tank serves as the feedstock reservoir for the sugar byproduct recovery system.

Thin stillage liquors are pumped through the two evaporation stages of Section H, which are operated in sequence with a single thermocompressor. Dehydration concentration of the liquors continues during passage through two flash drum stages. Bottoms from the flash drums are delivered to the molasses storage tank containing about 65% solids. This product meets necessary specifications for use in animal feeds or as a crude pentose sugar source for furfural manufacture. Overhead vapors from the flash drums contain minute quantities of short-chain fatty acids, furfural, ethanol, and methanol. These vapors are condensed and conveyed to a settling pond with other waste water streams for subsequent reclaim and recycle to the plant.

1.3 MATERIAL BALANCES

Individual material and energy balances (Figures 1-11 through 1-14) were calculated for the four plant sizes. These will vary somewhat with the feedstock wood. Please note that the wood intake, as indicated, is quantified on a dry basis and intended for economic/production determination. Green-ton equivalent must be factored and included for Milestone 5 to develop transportation costs.

1.4 PLANT COSTS

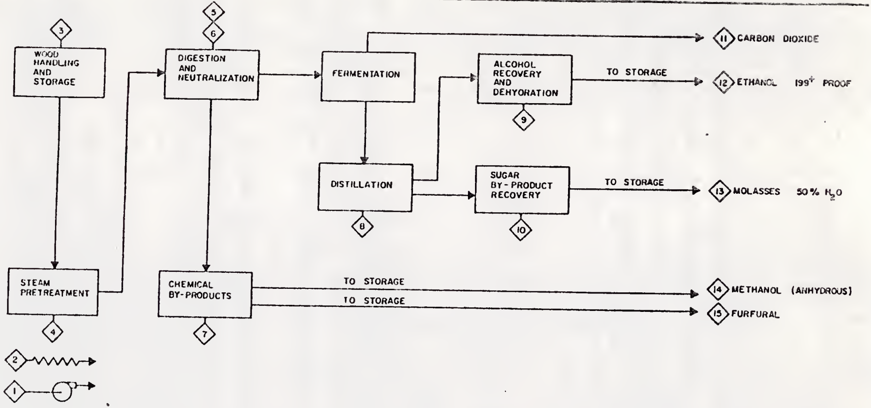
1.4.1 Estimating Procedure

The Amendment to the Grant Agreement defined other plant capacities that were of interest for possible wood-to-alcohol production, namely 1.25, 0.775, and 0.2 Mgpy. Costs for these plants were based on the 2.5 Mgpy plant.

million gallons per year

The basic "cost" definitions were prepared in extensive detail for a 2.5 million gpy plant are are shown in Exhibit G. These costs were based on Process Plant Construction Estimating Standards, Volume 1-4, Richardsons Engineering Services, Inc., 1981.

The sectional items were scaled "individually" and tabulated in Tables 1-1 through 1-4. These totals for each plant size were plotted for convenience of interpolation of other plant capacities. Dollar amounts throughout are in 1984 dollars (see Figure 1-15).



		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
FURFURAL	LBS/DAY															3000	
METHANOL	GAL/DAY														364		
MOLASSES	LBS/DAY													24,000			
ETHANOL	GAL/DAY												7,600				
CARBON DIOXIDE	LBS/DAY											49,100					
STEAM	LBS/DAY				380,000			35,000	167,200	76,000	96,000						
HYDRATED LIME	LBS/DAY						9530										
SULFURIC ACID	LBS/DAY					16,800											
WOOD INTAKE	ODT/DAY			155													
ELECTRICAL	KWH/DAY		54,528														
WATER	MILL. GAL/DAY	0.5															
STM.RCV & RECYCLE	LBS/DAY				(323,000)			(31,500)	(150,400)	(68,400)	(86,400)						

FLOW DIAGRAM AND MATERIAL BALANCE

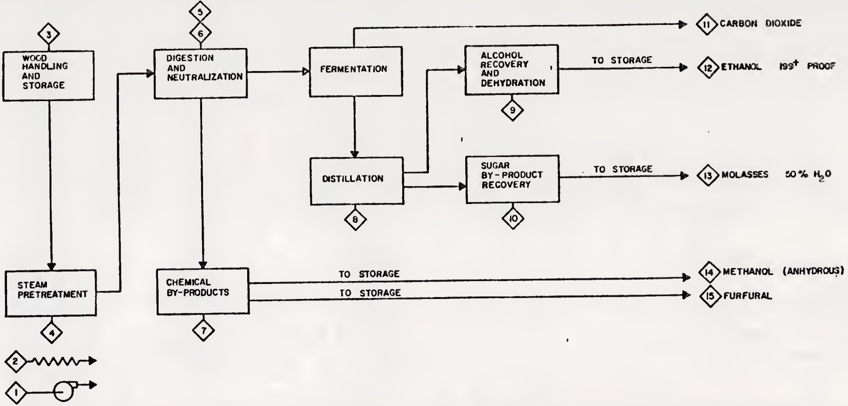
Fuel Ethanol Production From Wood Waste

SCALE NONE
DATE 11/81
APPROVED BY JHW
DRAWN BY MAS
REVISED

2.5 MILLION GPY PLANT

MULTITECH INC BUTTE MT
DRAWING NUMBER 24-000-110-B

FIGURE 1-11--2.5 MILLION GPY PLANT



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
FURFURAL LBS/DAY															1500	
METHANOL GAL/DAY														192		
MOLASSES LBS/DAY													12,000			
ETHANOL GAL/DAY												3800				
CARBON DIOXIDE LBS/DAY											34,600					
STEAM LBS/DAY				190,000			17,500	83,600	38,000	48,000						
HYDRATED LIME LBS/DAY						4770										
SULFURIC ACID LBS/DAY					8400											
WOOD INTAKE ODT/DAY			78													
ELECTRICAL KWH/DAY		17,300														
WATER MILL. GAL/DAY	0.25															
STM.RCV & RECYCLE LBS/DAY				(162,000)			(15,800)	(75,200)	(34,200)	(43,200)						

Fuel Ethanol Production From Wood Waste

SCALE: NONE
DATE 11/81
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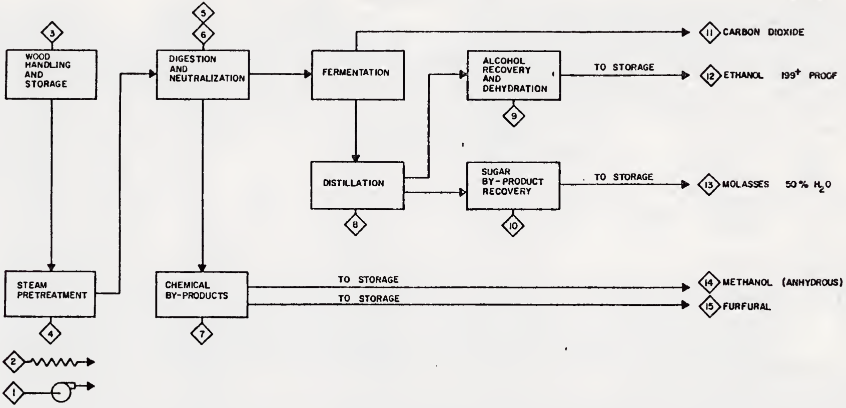
DRAWN BY MAS
REVISED

1.25 MILLION GPY PLANT

MULTITECH INC BUTTE MT
DRAWING NUMBER 24-000-110-8

FLOW DIAGRAM AND MATERIAL BALANCE

FIGURE 1-12--1.25 MILLION GPY PLANT



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
FURFURAL LBS/DAY															930	
METHANOL GAL/DAY														113		
MOLASSES LBS/DAY													7400			
ETHANOL GAL/DAY												2350				
CARBON DIOXIDE LBS/DAY											15,200					
STEAM LBS/DAY				117,700			10,800	51,800	23,500	29,700						
HYDRATED LIME LBS/DAY						2900										
SULFURIC ACID LBS/DAY					5200											
WOOD INTAKE ODT/DAY			48													
ELECTRICAL KWH/DAY		16,900														
WATER MILL. GAL/DAY	0.16															
STM.RCV & RECYCLE LBS/DAY				(100,000)			(9800)	(46,600)	(21,200)	(26,800)						

FLOW DIAGRAM AND MATERIAL BALANCE

Fuel Ethanol Production From Wood Waste

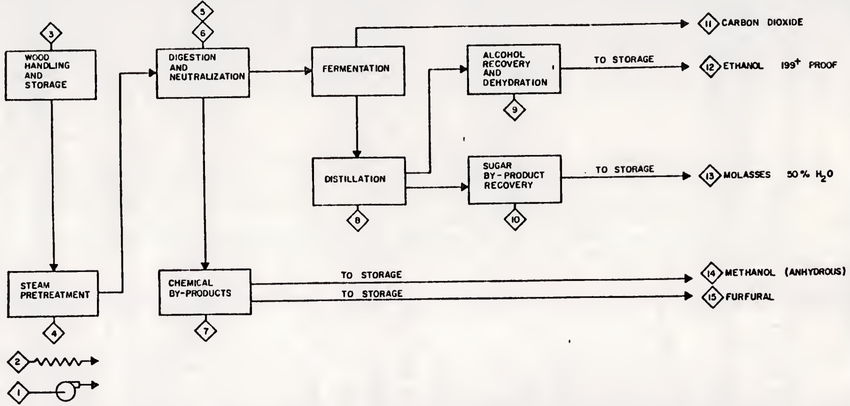
SCALE: NONE
DATE 11/81
APPROVED BY JHW
DRAWN BY MAS
REVISED

0.775 MILLION GPY PLANT

MULTITECH INC BUTTE MT

DRAWING NUMBER 24-000-110-8

FIGURE 1-13--0.775 MILLION GPY PLANT



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
FURFURAL LBS/DAY															240	
METHANOL GAL/DAY														29		
MOLASSES LBS/DAY													1920			
ETHANOL GAL/DAY												608				
CARBON DIOXIDE LBS/DAY											3930					
STEAM LBS/DAY				30,400			2800	13,400	6100	7700						
HYDRATED LIME LBS/DAY						762										
SULFURIC ACID LBS/DAY					1350											
WOOD INTAKE ODT/DAY			12.4													
ELECTRICAL KWH/DAY		4362														
WATER MILL. GAL/DAY																
STM.RCV & RECYCLE LBS/DAY				(25,800)			(2520)	(12,000)	(5500)	(6900)						

FLOW DIAGRAM AND MATERIAL BALANCE

Fuel Ethanol Production From Wood Wasta

SCALE: NONE
DATE 11/81
APPROVED BY JHW
DRAWN BY MAS
REVISED

0.2 MILLION GPY PLANT

MULTITECH INC BUTTE MT
DRAWING NUMBER 24-000-110-8

FIGURE 1-14--0.2 MILLION GPY PLANT

TABLE 1-1.--WOOD WASTES FUEL ETHANOL PRODUCTION PLANT COST SUMMARIES
PLANT CAPACITY - 2,500,000 GPY

ESTIMATE[1]			THOUSAND $[2]		
Acct.	Section	Item	Materials	Labor	Subcontract
100-0		Equipment			
	A	Wood Handling & Storage	304	60	
	B	Steam Pretreatment			1800
	C	Digestion	707	40	26
	D	Chemical Byproducts	237	16	
	E	Neutralization	423	24	
	F	Fermentation	668	65	
	G	Distillation	619	35	
	H	Sugar Byproducts	510	18	
1000-0	I	Boiler & Coal Handling	1233	23	
2-0	I	Site Improvements			108
3-0	I	Concrete Pads			379
4-0	I	Misc. Structural Steel			49
5-0	I	Mechanical			990
6-0	I	Electrical			156
		Subtotal	4701	281	3508
		10% Adminstration & Profit	470	28	351
		Indirect Labor @ 45%		127	
		Freight (1,758,000 @ 0.125/lb)	220		
		Subtotals	5391	436	3859
		Plant Design @ 6%			578
		Subtotal	5391	436	4437
		PLANT TOTAL	$10,264,000		

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[1] Process Plant Construction Estimating Standards, Volume 1-4, Richardsons Engineering Service, Inc., 1981.

[2] Dollar amounts throughout are in 1984 dollars.

TABLE 1-2.--WOOD WASTES FUEL ETHANOL PRODUCTION PLANT COST SUMMARIES
PLANT CAPACITY - 1,250,000 GPY

ESTIMATE[1]			THOUSAND $[2]		
Acct.	Section	Item	Materials	Labor	Subcontract
100-0		Equipment			
	A	Wood Handling & Storage	200	39	
	B	Steam Pretreatment			1188
	C	Digestion	467	40	
	D	Chemical Byproducts	156	16	
	E	Neutralization	279	24	
	F	Fermentation	441	65	
	G	Distillation	408	35	
	H	Sugar Byproducts	337	18	
1000-0	I	Boiler & Coal Handling	814	23	
2-0	I	Site Improvements			87
3-0	I	Concrete Pads			302
4-0	I	Misc. Structural Steel			32
5-0	I	Mechanical			700
6-0	I	Electrical			103
		Subtotal	3102	260	2412
		10% Adminstration & Profit	310	26	241
		Indirect Labor @ 45%		117	
		Freight (1,160,000 @ 0.125/lb)	145		
		Subtotals	3557	403	2653
		Plant Design @ 6%			397
		Subtotal	3557	403	3050
		PLANT TOTAL	$7,010,000		

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[1] Process Plant Construction Estimating Standards, Volume 1-4, Richardsons Engineering Service, Inc., 1981.

[2] Dollar amounts throughout in 1984 dollars.

TABLE 1-3.--WOOD WASTES FUEL ETHANOL PRODUCTION PLANT COST SUMMARIES
PLANT CAPACITY - 775,000 GPY

ESTIMATE[1]			THOUSAND $[2]		
Acct.	Section	Item	Materials	Labor	Subcontract
100-0		Equipment			
	A	Wood Handling & Storage	160	35	
	B	Steam Pretreatment			960
	C	Digestion	370	37	
	D	Chemical Byproducts	125	15	
	E	Neutralization	226	23	
	F	Fermentation	357	63	
	G	Distillation	330	32	
	H	Sugar Byproducts	272	16	
1000-0	I	Boiler & Coal Handling	620	21	
2-0	I	Site Improvements			80
3-0	I	Concrete Pads			270
4-0	I	Misc. Structural Steel			27
5-0	I	Mechanical			593
6-0	I	Electrical			90
		Subtotal	2460	242	2034
		10% Adminstration & Profit	246	24	203
		Indirect Labor @ 45%		109	
		Freight (950,000 @ 0.125/lb)	119		
		Subtotals	2825	375	2237
		Plant Design @ 6%			326
		Subtotal	2825	375	2563
		PLANT TOTAL	$5,763,000		

[1] Process Plant Construction Estimating Standards, Volume 1-4, Richardsons Engineering Service, Inc., 1981.

[2] Dollar amounts throughout are in 1984 dollars.

TABLE 1-4.--WOOD WASTES FUEL ETHANOL PRODUCTION PLANT COST SUMMARIES
PLANT CAPACITY - 200,000 GPY

ESTIMATE[1]			THOUSAND $		
Acct.	Section	Item	Materials	Labor	Subcontract
100-0		Equipment			
	A	Wood Handling & Storage	86	23	
	B	Steam Pretreatment			509
	C	Digestion	200	16	8
	D	Chemical Byproducts	67	7	
	E	Neutralization	120	10	
	F	Fermentation	189	26	
	G	Distillation	175	14	
	H	Sugar Byproducts	144	7	
1000-0	I	Boiler & Coal Handling	349	10	
2-0	I	Site Improvements			43
3-0	I	Concrete Pads			152
4-0	I	Misc. Structural Steel			14
5-0	I	Mechanical			396
6-0	I	Electrical			63
		Subtotal	1330	113	1185
		10% Adminstration & Profit	133	11	119
		Indirect Labor @ 45%		51	
		Freight (1,160,000 @ 0.125/lb)			
		Subtotals	1463	175	1304
		Plant Design @ 6%			177
		Subtotal	1463	175	1481
		PLANT TOTAL		$3,119,000	

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[1] Process Plant Construction Estimating Standards, Volume 1-4, Richardsons Engineering Service, Inc., 1981.

[2] Dollar amounts throughout are in 1984 dollars.

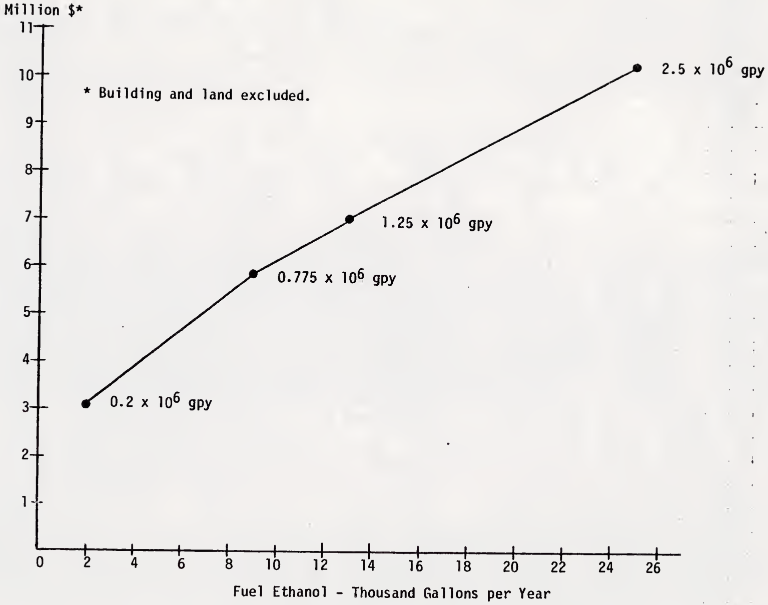


FIGURE 1-15--WOOD WASTE - FUEL ETHANOL PLANT COST
(Capacity vs. Cost)

Land and buildings are excluded because they are site-specific. Also, lease of land and buildings is probable. Contact was made with Jim Davidson of the Anaconda Local Development Committee and Mark Montgomery of the Livingston Chamber of Commerce. Assurances as to probable available sites including buildings were given in both instances. Informal contacts at Lincoln indicated site availability would not be a major concern.

The following cost scaling formula was employed:

$$\frac{C_1}{C_2} = \frac{S_1}{S_2}^{X}$$

where:

C_1 = known cost of item/plant for S_1;

C_2 = scale cost for S_2;

S_1 = plant capacity costing C_1;

S_2 = capacity cost scaled to C_2; and

X = Exponents historically derived experience from many sources.

The methodology employed in this report for costing and scaling is widely used for preliminary costing of process equipment and plants. The exponents for the items/systems have been established with information obtained from other estimators employeed in specialized industrial equipment manufacturering and by engineering companies. In this estimate the accuracy of the base cost is probably better than (-10 percent to +25 percent). Consequently, the scaled costs probably have a corresponding accuracy.

1.4.2 Comments

When scaled down, the plant cost per unit of capacity increases geometrically, thereby reducing the economic potential.

As stated in the Summary, other feedstocks used in conjunction with wood wastes can probably improve the plant economics. The Livingston area appears to be a case-in-point, and the augmenting feedstock could be straw. Mark Montgomery of Livingston indicated that the straw resource in his area is probably substantial and volunteered to provide additional information as a project develops.

1.5 MANPOWER REQUIREMENTS

The manpower requirements can vary significantly with the organizational structure existing within the subject company.

Management

A working plant supervisor can serve adequately in the management function, wherein sales and policy are controlled from a well organized company structure which has other operations.

A single entrepreneurial manager can be adequate for the plant-scale of this investigation.

Clerical

A single part-time clerical person can suffice for these plants, performing record keeping, billing and correspondence. These plants should not require an accountant on a full-time basis, although an accounting firm should be retained to provide typical accounting services.

Operation and Maintenance

It is suggested that the following four categories of job classification be used:

1. Operator-Maintenance Person;
2. Operator-Maintenance Helper;
3. Haulers-Delivery (Wood Waste and Product Delivery); and
4. Driver-Operator.

To obtain efficient economics, flexibility of plant functions is essential. Two persons per shift is mandatory for general reasons of safety and in the event of worker injury. For small plants, flexibility of manpower is imperative for good economics.

Personnel assigned to unloading and loading operations should be part of the labor requirement; additionally, these personnel should work in the plant when their primary functions are not required.

It is suggested that for this analysis, manpower should be as shown in Table 1-5.

TABLE 1-5.--MANPOWER REQUIREMENTS

Plant Capacity (gpy)	Administrative	Clerical	Operator/ Maintenance*	Drivers
200,000	Part-Time	Part-Time	9	2
775,000	Part-Time	Part-Time	9	2
1,250,000	Part-Time	Part-Time	9	3
2,500,000	Part-Time	1	10	5

* Safety considerations require a minimum of two persons for a plant operating in a separate location. If the ethanol plant is part of a complex with good communications, and other personnel are in the plant vicinity, these Operator/ Maintenance personnel can be reduced by three persons in each of the plants.

2.0 ECONOMIC ANALYSIS

2.1 INTRODUCTION

Primary objective of the Milestone No. 5 Report was to analyze economic factors that influence the cost of product and economic viability for plants located at Anaconda, Livingston, and Lincoln, Montana. Four plant capacities were specifically analyzed and tabulated.

2.2 GENERAL ECONOMIC FACTORS

The economics of FGE manufacture from wood wastes and a definition of plant costs involved therein are discussed in subsequent paragraphs.

2.2.1 Plant Equipment

In the Milestone No. 3 report, the estimated costs of plant equipment were prepared with the assumption that all purchased equipment would be new. Plant investment represents a substantial portion of product costs; therefore to reduce such costs all of the equipment was examined that is neither site-specific nor unique to this production process and are readily available on the used-equipment market. A partial list of used-equipment merchants is presented in Exhibit A. Use of this equipment, which is generally marketed at 5% to 30% of the "new" price, could reduce total plant costs by 26 to 36 percent (Table 2-1).

TABLE 2-1. USED EQUIPMENT--FUEL ETHANOL PLANT

Plant Capacity FGE Million gpy	Plant with All New Equipment	Plant With Some Used Equipment	Percent Reduction in Plant Cost
0.2	$3,119,000	$2,294,000	26
0.775	5,763,000	3,868,000	33
1.25	7,010,000	4,460,000	36
2.5	10,264,000	6,554,000	36

The economic effects of interest rates and depreciation for varying plant sizes are presented in Tables 2-2 and 2-3. The interest payment is for the first year, and the depreciation is constant over a five year period. The effect of new equipment vs. partial used equipment is further shown by comparing Tables 2-2 and 2-3.

The impacts on cost of invested capital is shown by a comparison of interest rates and unit costs as plotted in Figure 2-1. These curves, drawn from the used-equipment data of Table 2-3, graphically illustrate the trends of both Tables 2-2 and 2-3.

2.2.2 Plant Inputs and Outputs

Plant inputs and outputs as defined by material balances were calculated for the four plant sizes and are presented in Table 2-4.

2.2.3 Revenues

The potential revenue generated from each size plant was based upon the product outputs shown in Table 2-4 and upon March 1984 prices for the products. The results tabulated in Table 2-5 show the unit value of all products per gallon of FGE to be $2.21 without the incentive payment, and $2.51 with the incentive payment. The unit revenue value applys to all plant sizes. The Montana State Tax Incentive of $0.30 per gallon, effective on April 1, 1986, as abstracted from Montana Energy Tax Benefits (see Exhibit B) was included as applicable. This subsidy is used in all of the basic plant evaluations because a plant would not be completed until late 1985 or 1986.

TABLE 2-2. PLANT COST ANALYSIS--INTEREST AND DEPRECIATION ANACONDA SITE

(All Equipment New, Except Boilers; Buildings Rented)

Plant Capacity (10^6 Gal/Yr):	0.2	0.775	1.25	2.5
Installed Cost Standard Plant	$3,924,000	$5,324,000	$6,425,000	$9,377,000
Depreciation @ 20%/year	784,800	1,064,800	1,285,000	1,875,400
Per gallon of FGE, $	3.92	1.37	1.03	0.750
Interest @ 14%	549,400	745,000	899,500	1,313,800
Per gallon of FGE, $	2.75	0.96	0.72	0.52
Interest @ 12%	470,900	638,900	771,000	1,125,000
Per gallon of FGE, $	2.35	0.82	0.62	0.45
Interest at 10%	392,400	532,400	642,500	937,700
Per gallon of FGE, $	1.96	0.69	0.51	0.38
Interest @ 8%	313,900	425,900	514,000	750,200
Per gallon of FGE, $	1.57	0.55	0.41	0.30
Interest @ 6%	235,400	319,400	385,500	562,600
Per gallon of FGE, $	1.18	0.41	0.31	.23

TABLE 2-3. PLANT COST ANALYSIS
ANACONDA SITE

(Partial Used Equipment and Rented Building)

Plant Capacity (10^6 Gal/Yr):	0.2	0.775	1.25	2.5
Installed Cost of Plant	$2,294,000	$3,868,000	$4,460,000	$6,554,000
Deduct for Boiler	195,000	439,000	585,000	887,000
Investment in Plant	2,099,000	3,329,000	3,875,000	5,667,000
Depreciation @ 20%/year	420,000	666,000	775,000	1,133,000
Per gallon of FGE, $	2.10	0.85	0.62	0.45
Interest @ 14%	294,000	466,000	543,000	793,000
Per gallon of FGE, $	1.47	0.60	0.44	0.32
Interest @ 12%	252,000	400,000	565,000	680,000
Per gallon of FGE, $	1.26	0.52	0.37	0.27
Interest at 10%	210,000	333,000	388,000	567,000
Per gallon of FGE, $	1.05	0.42	0.39	0.23
Interest @ 8%	168,000	266,000	310,000	453,000
Per gallon of FGE, $	0.84	0.34	0.25	0.18
Interest @ 6%	126,000	200,000	233,000	340,000
Per gallon of FGE, $	.63	0.26	0.19	0.14

FIGURE 2-1 UNIT COST OF CAPITAL INVESTED
INTEREST AND DEPRECIATION

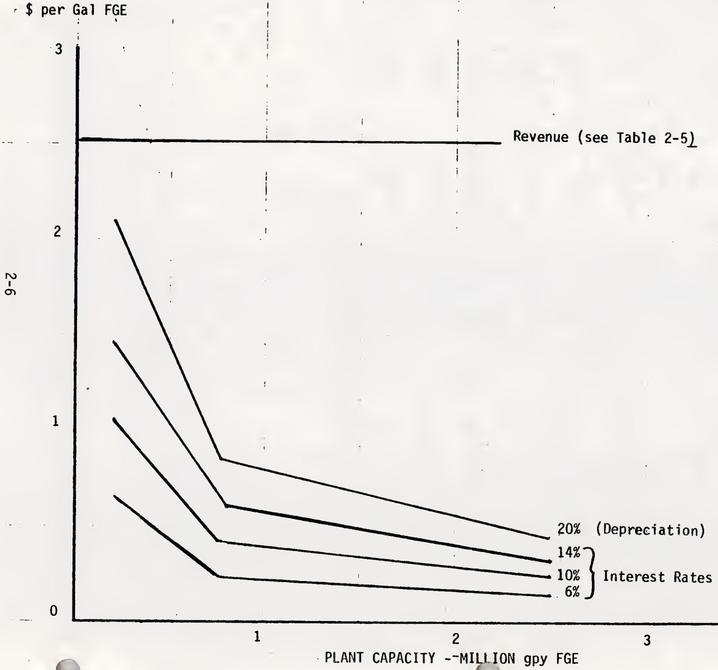


TABLE 2-4. PLANT INPUTS AND OUTPUTS

Plant Capacity (10^6 Gal/Yr):	0.2	0.775	1.25	2.5
Inputs				
Wood Wastes - Green Ton/Year	8,052	31,202	50,325	100,650
Sulfuric Acid, Ton/Year	222	859	1,386	2,772
Lime Hydrate, Ton/Year	366	1,418	2,287	4,574
Electricity, kWh/year	1,439,500	5,578,000	8,997,000	17,994,000
Coal, Ton/Year	1,676	6,496	10,478	20,955
Water, 10^6 Gal/Year	13.2	51.	82.5	165
Outputs				
Anhydrous Ethanol Gal/Year	200,000	775,000	1,250,000	2,500,000
Anhydrous Methanol Gal/Year	10,800	37,200	60,000	120,000
Tech-Grade Furfural lb/year	79,200	306,900	495,000	990,000
Syrup Ton/Year	317	1,228	1,980	3,960

TABLE 2-5. REVENUES

	Thousand Dollars per Year			
Plant Capacity (10^6 Gal/Yr):	0.2	0.775	1.25	2.5
Ethanol - $1.80 per gallon*	$ 360	$1,395	$2,250	$4,500
Methanol - $.75 per gallon*	7	28	45	90
Furfural - $6.66 per lb.*	52	202	327	653
Syrup - $70.00 per ton	22	86	138	277
Subtotal	441	1,711	2,760	5,520
Unit Value per Gallon FGE	2.20	2.21	2.21	2.21
State of Montana Incentive $0.30 per gallon**	60	233	375	750
TOTAL	501	1,944	3,135	6,270
Unit Value/Gallon FGE	2.51	2.51	2.51	2.51

* Prices are current: Chemical Market Reporter, March 19, 1984.

**Montana Incentive Payment; effective April 1, 1986.

Note: 7/1/83 - 70¢/gal; 4/1/84 - 50¢/gal; 4/1/86 - 30¢/gal; incentive terminates 4/1/89.

Because the plant cannot possibly be built until late in 1985, or 1986, we have used the incentive payments for 1986 for these computations.

2.2.4 Cost of Plant Inputs

The cost of inputs for the four plant sizes, as calculated from quantities contained in Table 2-4, are as shown in: Anaconda Site (Table 2-6) and Livingston and Lincoln Sites (Table 2-7). The cost of electrical power was derived in all cases from the Montana Power Company schedule (Exhibit C). The cost of water for Anaconda was calculated from the schedule of Exhibit D. Water for Lincoln and Livingston is from wells and no separate water charge is applicable. In these tables, maintenance costs (other than labor) are included in the line for Supplies and Parts.

Both tabulations of input costs show the cost on a unit basis to be about \$.50 per gallon without wood costs, and with a wood cost of \$20 per ton, the total input cost to be about \$1.30 per gallon. These unit costs do not vary appreciably for the three larger plants, but for the smaller plant (0.2 Mgpy) the input costs are 20% higher excluding wood and 8% higher including the cost of wood.

The importance of the delivered costs of the wood waste translated into unit costs per gallon of FGE are clearly shown for the Anaconda Site data in Figure 2-2. While the costs of consumables other than wood are nearly the same at all three sites, it is probable that the delivered cost of wood will change for each site as the cost of haulage could vary significantly from site to site.

TABLE 2-6. COST OF INPUTS
ANACONDA SITE

	Thousand Dollars per Year			
Plant Capacity - Million Gal FGE/Yr:	0.2	0.775	1.25	2.5
Sulfuric Acid @ $80 per ton*	$ 18	$ 69	$111	$ 221
Lime Hydrate (bags) @ $42.40 per ton*	16	60	97	194
Electricity (MPC Schedule)**	31	99	159	313
Supplies and Parts (0.5% Plant Cost)	15	27	32	47
Coal @ $20 per ton	34	130	205	419
Water (Anaconda Schedule)***	6	21	33	62
Subtotal	120	406	637	1,256
Cost/Gallon	0.600	0.52	0.51	0.50
Total Cost of Inputs with:				
Green Wood @ $10/ton	201	718	1,140	2,263
Cost/Gallon	1.01	0.93	0.91	0.91
Green Wood @ $20/ton	282	1,030	1,643	3,270
Cost/Gallon	1.41	1.33	1.31	1.30
Green Wood @ $30/ton	363	1,342	2,146	4,277
Cost/Gallon	1.82	1.73	1.71	1.71
Green Wood @ $40/ton	444	1,654	2,649	5,284
Cost/Gallon	2.22	2.13	2.12	2.11
Green Wood @ 50/ton	525	1,966	3,152	6,293
Cost/Gallon	2.62	2.53	2.52	2.52

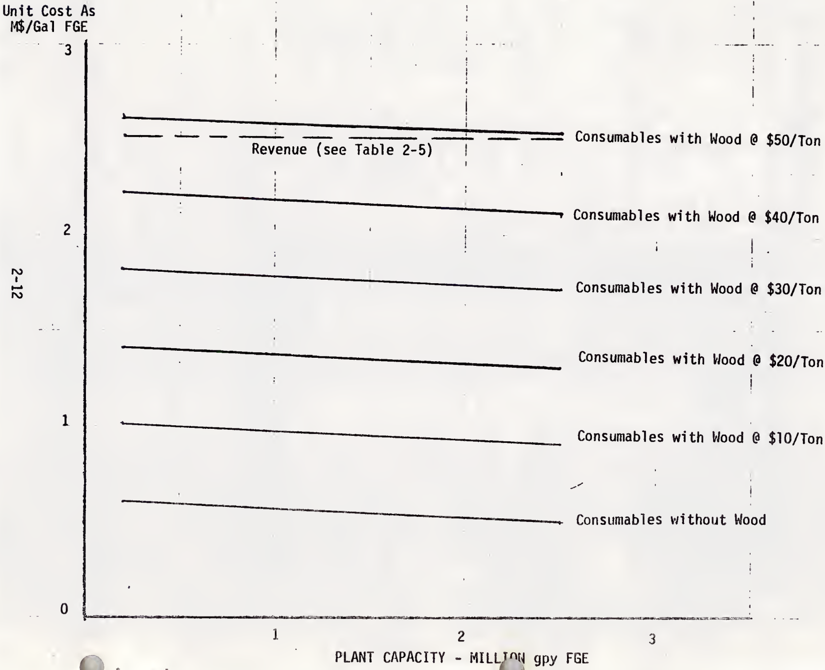
*Chemical Market Reporter, March 19, 1984.
**Approved 7/18/83; Exhibit C, MPC Schedule.
***Anaconda Water Schedule, issued 5/19/83, Exhibit D.

TABLE 2-7. COST OF INPUTS
LIVINGSTON AND LINCOLN SITES

	Thousand Dollars per Year			
Plant Capacity - Million Gal FGE/Yr:	0.2	0.775	1.25	2.5
Sulfuric Acid @ $80 per ton*	$ 18	$ 69	$ 111	$ 221
Lime Hydrate (bags) @ $42.40 per ton*	16	60	97	194
Electricity (MPC Schedule)**	31	99	159	313
Supplies and Parts (0.5% Plant Cost)	15	27	32	47
Coal @ $20 per ton	34	130	205	419
Subtotal	114	385	604	1,194
Cost/Gallon	0.57	0.50	0.48	0.47
Total Input Costs with:				
Green Wood @ $10/ton	195	697	1,107	2,195
Cost/Gallon	0.98	0.90	0.88	0.88
Green Wood @ $20/ton	276	1,009	1,610	3,196
Cost/Gallon	1.38	1.30	1.28	1.28
Green Wood @ $30/ton	357	1,321	2,113	4,197
Cost/Gallon	1.79	1.70	1.69	1.68
Green Wood @ $40/ton	438	1,633	2,616	5,198
Cost/Gallon	2.19	2.11	2.09	2.08
Green Wood @ 50/ton	519	1,945	3,119	6,199
Cost/Gallon	2.50	2.51	2.50	2.48

*Chemical Market Reporter, March 19, 1984.
**Approved 7/18/83; Exhibit C, MPC Schedule.
***Anaconda Water Schedule, issued 5/19/83, Exhibit D.

FIGURE 2-2 UNIT COST OF INPUTS



2.2.5 Manpower and Services

Manpower and services cost analyses were based upon typical chemical plant operations of similar sizes, and are found in Table 2-8 and graphically depicted in Figure 2-3.

The impact of plant capacity is significant on the unit cost of manpower and services increasing from $.14 for the 2.5 Mgpy plant to $1.35 per gallon for the 0.2 Mgpy plant.

2.2.6 Working Capital

A tabulation of working capital requirements and costs are presented in Table 2-9. Since working capital is a balance of income cash flow to payments, the unit cost does not change significantly with plant capacity.

2.2.7 Insurance and Local Taxes

Insurance and local taxes have been estimated as 3% of the plant cost which is a generalized but typical cost and has been used throughout these calculations. Because these data appear elsewhere herein, no specific table has been prepared.

2.2.8 Loan Repayment and Interest

It was assumed that repayment would be uniformly paid in 10 equal and yearly installments which is a typical loan repayment schedule.

TABLE 2-8. MANPOWER AND SERVICES COST ANALYSIS
FUEL ETHANOL FROM WOOD WASTES

	Dollars per Year			
Plant Capacity - Million gpy:	0.2	0.775	1.25	2.5
Admin. and Sales (part time)	$ 25,000	$ 25,000	$ 25,000	$ 35,000
Accounting Service Co.	3,000	5,000	10,000	15,000
Clerical (part time)	10,000	10,000	10,000	10,000
Operator - Maintenance				
Working Supervisor	33,000	33,000	33,000	33,000
Shift Lead Man ($29,000)	116,000	116,000	116,000	145,000
Helper ($20,800)	83,000	83,000	83,000	104,000
Total Cost	270,500	272,000	277,000	342,000
Cost ($ per Gal.) of FGE	1.35	0.35	0.22	0.14

NOTE: Rates include benefits; drivers are not included.

FIGURE 2-3 UNIT COST OF MANPOWER AND SERVICES

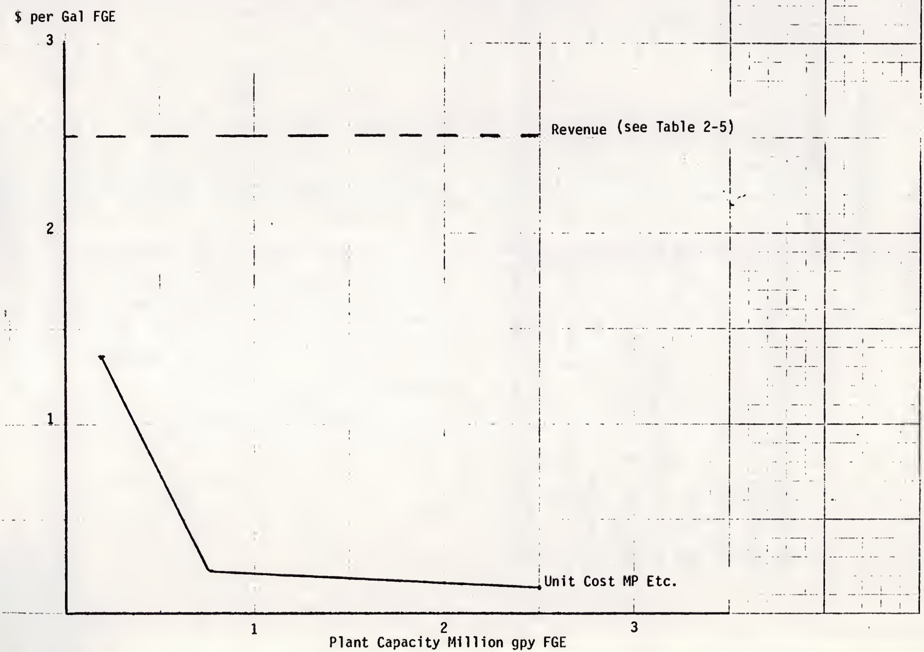


TABLE 2-9. WORKING CAPITAL ANALYSIS

	Thousands of Dollars			
Plant Capacity - Million gpy:	0.2	0.775	1.25	2.5
*25% of Inputs	$ 70	$ 260	$ 410	$ 820
15% of Labor	40	41	42	51
25% of Rent	10	16	16	16
Total Working Capital	120	317	468	887
Working Capital Interest @ 14%	16	41	61	115
Cost per Gal FGE	.08	.05	.05	.05

* These payments vs. cash flow (with typical three-month accounts receivable) require a working capital of approximately the above.

Interest was assumed as 14% per year on the unpaid balance. No table was prepared; these values are tabulated in the "cash analysis" portion of tables found in Section 2.3.

2.2.9 Income Taxes

State and federal income taxes were based on current rates as tabulated in Table 2-10. These tax rates were used as a basis for calculation in all of the subsequent relevant tables.

2.3 INVESTMENT RECOVERY AND CASH ANALYSIS

The two evaluations of investment recovery and cash analysis presented here were based upon previously estimated costs and revenues for the three sites.

The Anaconda site has the unique "smelter-site" economics of existing buildings and utilities that were originally part of the Anaconda Minerals Company operation. This assumption is based upon the availability of the Arbiter Plant from the Anaconda Local Development Authority. Economics for this plant were analyzed separately; data developed is shown in Table 2-11.

Because they require a "grass-roots" plant concept, the Lincoln and Livingston sites are similar to each other. A single analysis is applicable to both and is presented in Table 2-12.

TABLE 2.10. TAX RATES - INCOME

RATE:

Montana State: 6.75% (flat rate)

RATE:

Federal:

First $25,000	15%
Next $25,000	18%
Next $25,000	30%
Next $25,000	40%
All Over $100,000	46%

TABLE 2-11. INVESTMENT RECOVERY CASH ANALYSIS
ANACONDA SITE
(New and Used Equipment)

	Thousands of Dollars			
Plant Capacity - Million gpy:	0.2	0.775	1.25	2.5
Plant Cost (investment)	$2,099	$3,329	$3,875	$5,667
Costs per Year:				
Inputs (with wood @ $20/ton)	282	1,030	1,643	3,270
Rent	40	65	65	65
Labor, Mgmt. and Accounting	270	272	277	342
Working Capital Interest (14%)	16	41	61	115
Insurance and Local Taxes (3%)	63	100	147	170
Subtotal	671	1,508	2,193	3,962
Loan Repayment 10% per Year	210	333	388	567
Interest (14%) 10 year average	140	233	271	397
Total Cash Out-Flow	1,021	2,074	2,852	4,926
Revenue	501	1,944	3,135	6,270
Net Cash Balance[a]	(520)	(130)	283	1,344
Loan Repayment	210	333	388	567
Gross Income	(310)	203	671	1,911
Depreciation (20%)	420	666	975	1,133
Taxable Income after deducting depreciation	(730)	(463)	(304)	778
Total State and Federal Tax	0	0	0	384
Net Profit After Taxes	0	0	0	394

Investment Recovery - Years

Wood @ $20/ton		16	5.7	2.7
Wood @ $30/ton		46	22.7	3.7
Wood @ $40/ton				10.0

(a) Parentheses indicate negative number.

TABLE 2-12. INVESTMENT RECOVERY AND CASH ANALYSIS
LIVINGSTON AND LINCOLN SITES
(New and Used Equipment)

	Thousand of Dollars			
Plant Capacity - Million gpy:	0.2	0.775	1.25	2.5
Installed Cost of Plant	$2,294	$3,868	$4,460	$6,554
Land and Buildings	260	315	390	770
	2,554	4,183	4,850	7,324
Cost per Year				
Inputs with Wood @ $20/ton	276	1,009	1,610	3,208
Labor, Management, and Accounting	270	272	277	342
Working Capital Interest (14%)	16	41	61	115
Insurance and Local Taxes (3%)	77	125	146	220
Subtotal	639	1,447	2,094	3,885
Loan Repayment 10%	255	418	485	732
Interest (14% - 10 year average)	179	293	340	512
Total Cash Outflow	1,073	2,158	2,919	5,129
Revenue	501	1,944	3,135	6,270
Net Cash Balance[a]	(572)	(214)	216	1,141
Loan Repayment	255	418	485	732
Gross Income	(317)	204	701	1,872
Depreciation (20%)	510	837	970	1,465
Taxable Income After Deducting Depreciation	(827)	(633)	(269)	407
Total State and Federal Tax	0	0	0	94
Net Profit After Taxes	0	0	0	313

	Investment Recovery - Years			
Wood @ $20/ton		20	6.9	2.9
Wood @ $30/ton			24.2	7.8
Wood @ $40/ton				12.2

(a) Parentheses indicate negative number.

Constraints on the investment recovery and cash analysis were the following:

- Tax credits were not considered;
- No escalation was used on output or input prices - all costs are in 1984 dollars;
- A conservative value for the incentive value was used, i.e., $.30 per gallon in April 1986 versus the April 1984 value of $.50 per gallon;
- Wood availability was as defined in previous milestones; and
- Wood costs were $20 per ton.

Time required to recover the original plant investment is often used as an initial criterion for evaluating economic feasibility of a project. The The results of an analysis to determine payback period; are presented at the bottom of Tables 2-11 and 2-12. These data show that plant sizes of 1.25 Mgpy and 2.5 Mgpy are probably economically feasible with wood costs of $20 per ton, and that only the 2.5 Mgpy plant would be economically attractive at $30 per ton. The data also show that the Anaconda site is slightly faster in payback period due to lower initial capital costs.

INFORMATION SOURCES

LITERATURE CITED

Greene, M. M., 1982. Patent Disclosure, Process for Cryopulverizing Utilizing Carbon Dioxide as the Coolant, MultiTech.

Montana Department of Natural Resources and Conservation (DNRC), 1982. Amendment to Grant Agreement No. 451-811, Amendment No. 1. Entered into and between the Department and MultiTech on December 7, 1982, Helena, Montana.

MultiTech, 1983. Fuel Grade Ethanol Production Using Wood Waste (Residues) at Selected Sites in Montana. Feasibility Study - Milestone 1 Report, Timber Harvest Residue Inventory Study. Prepared for the Montana DNRC, Bureau of Alternative Renewable Energy Sources under Grant Agreement No. 451-811, Amendment No. 1, Helena, Montana.

MultiTech, 1982. Fuel Ethanol Production from Wood Waste: Feasibility of a Plant at Anaconda, Montana. Prepared in two volumes by MultiTech for the Montana DNRC Bureau of Alaternative Renewable Energy Sources under Grant Agreement 451-811 (1981), Helena, Montana.

Richardsons Engineering Service, Inc., 1981. Process Plant Construction Estimating Standards, Volumes 1-4.

PERSONAL CONTACTS

Davidson, James, February 1984. Anaconda Local Development Committee.

Montgomery, Mark, February 1984. Livingston Chamber of Commerce.

EXHIBIT A

REPRESENTATIVE LIST OF USED-EQUIPMENT SALES COMPANY

EXHIBIT A

REPRESENTATIVE LIST OF USED-EQUIPMENT SALES COMPANIES

Company/Location	Telephone
Universal Process Equipment Roosevelt, New Jersey	609-443-4545
Chem-Oil Equipment Company Houston, Texas	713-723-9933
Machinery and Equipment Company San Francisco, California	800-227-4544
Aaron Equipment Company Schiller Park, Illinois	312-678-1500
IDM South Riner, New Jersey	201-390-9550
Federal Equipment Company Cleveland, Ohio	216-271-3500
Louisiana Chemical Equipment Company La Porte, Texas	713-471-4900
Perry Machinery Corporation Hainesport, New Jersey	609-267-1600

EXHIBIT B

MONTANA ENERGY TAX BENEFITS

EXHIBIT B

MONTANA ENERGY TAX BENEFITS

January 1984 (page 6). Issued by Montana Department of Natural Resources and Conservation.

ALCOHOL TAX INCENTIVE

Individuals or businesses in Montana who produce alcohol from Montana-grown agricultural products for use as gasohol can take advantage of a tax incentive established by the 1983 Legislature (Section 15-70-522, MCA). The alcohol producer is entitled to the following payment from the Department of Revenue for each gallon of alcohol distilled:

- beginning July 1, 1983, 70¢ per gallon;
- beginning April 1, 1985, 50¢ per gallon;
- beginning April 1, 1986, 30¢ per gallon;
- on April 1, 1989, this tax incentive will terminate.

This payment will be reduced by the 15 cents per gallon gasoline license tax imposed on alcohol produced for blending and sale as gasohol. The payment would be reduced further if the amount of gasohol sold in any six-month period exceeds a specified share of the total non-aviation gasoline and gasohol sold for that period.

Before beginning to produce or distribute alcohol in Montana, an individual must purchase a gasoline distributor's license from the State Department of Revenue. In order to qualify for payment of this tax incentive, he must submit a form identifying the amount of alcohol sold for use as gasohol and provide records showing the amount sold and who was the purchaser.

More information on the alcohol tax incentive is available from the Department of Revenue's Motor Fuel Tax Division, Capitol Station, Helena, Montana 59620, 444-3473. This office will also answer questions regarding licensing and reporting requirements.

EXHIBIT C

PSC OF MONTANA, GENERAL ELECTRIC SERVICE

Form 114-18

Public Service Commission of Montana

THE MONTANA POWER COMPANY
(Name of Company)

Sheet No. GS-83, Suppl. #1
Canceling Sheet No. GS-83
Page 1 of 2

EXHIBIT C

Schedule GS-83, Suppl. #1

GENERAL ELECTRIC Service

AVAILABLE FOR: All electric service required when supplied through one meter at one point of delivery. Not available for standby, breakdown, resale or shared service.

TYPE OF SERVICE: Sixty cycle alternating current at such phase and voltage as Company may have available.

RATE: Net Monthly Bill:

First	20 kWh or less per month for	$2.286249
Next	80 kWh per month @	$0.074003 per kWh
Next	1700 kWh per month @	$0.063425 per kWh
Next	3200 kWh per month @	$0.039055 per kWh
Next	15000 kWh per month @	$0.023268 per kWh
Next	200 kWh per kilowatt of demand per month @	$0.019742 per kWh
All additional kWh @		$0.014530 per kWh

PLUS

First 10 kilowatts -- no charge
Next 20 kilowatts -- $2.099854 per kilowatt
All additional kilowatts -- $1.747323 per kilowatt

MINIMUM BILL: $2.286249 per month

REBATE: In accordance with MPSC Order 4938b, the rate(s) above will be reduced in the month of December 1983 to rebate the over-collection resulting from MPSC Interim Order 4938 and Order 4938a.

DETERMINATION OF KILOWATTS: The average kilowatts supplied during the 15-minute period of maximum use during the month, as determined by permanently installed indicating type meter, except where service agreement or regulations specify a minimum demand billing.

SPECIAL TERMS AND CONDITIONS: (1) The Company may require the customer to pay the cost of installing and removing all the facilities required to supply seasonal and short-term service. Customer must pay the cost of installing and removing all the facilities required for rendering temporary service.

(continued)

Issued ________ (Date)
By Steven Paul Cook (Signature of Officer of Utility)

Approved July 18, 1983 (Date)
332018/3
Docket No. 82.8.54, Order No. 4938b
(Space for Stamp or Seal of Commission)

Effective for electric service rendered on and after (Date) June 30, 1983

PUBLIC SERVICE COMMISSION OF MONTANA
Madeline L. Cottrill
Secretary.

*Space below these lines for use of Commission only.

EXHIBIT D

PSC OF MONTANA, WATER SERVICE

EXHIBIT D

Public Service Commission of Montana

BUTTE WATER COMPANY
BUTTE, MONTANA
(Name of Company)

Sheet No. 6-P
Cancelling Sheet No.

Schedule M. R. - A.

GENERAL METER RATES - ANACONDA, MONTANA Service

Service

Available for: Anaconda, Montana

Rates: Effective upon Approval.

METER RATES

Minimum Bill - Per Month

5/8" meter - $	3.20	3" meter -	23.75
3/4" meter -	4.60	4" meter -	34.85
1" meter -	5.90	6" meter -	58.05
1-1/4" meter -	7.90	8" meter -	83.95
1-1/2" meter -	9.05	10" meter -	116.10
2" meter -	11.60		

Cubic Feet Per Month		Rate Per 100 Cu. Ft.
First	1,000	.485
Next	4,000	.451
Next	5,000	.382
Next	60,000	.329
Next	930,000	.295
Over	1,000,000	.261

Service to Schools

At General Service rates with 10 percent discount.

Service to Cemeteries

At General Service rates with 20 percent discount.

Issued May 19, 1983 By C. M. Young
(Date) (Signature of Officer of Utility)

Approved
(Date)
Docket No. 83.3.16, Order No. 4978

Effective For water service rendered on & after
(Date) May 2, 1983

(Space for Stamp or Seal of Commission)

PUBLIC SERVICE COMMISSION OF MONTANA.
Madeline L. Cottrill
Secretary.

*Space below these lines for use of Commission only.

EXHIBIT E

LETTER FROM LIVINGSTON AREA CHAMBER OF COMMERCE

EXHIBIT E

LIVINGSTON AREA
CHAMBER OF COMMERCE

March 28, 1984

Dear Monroe:

It seems that all of the available buildings in Livingston are in a zoned area that will not permit a Fuel Alcohol Plant. However, I have talked with the city-county planner and he has informed me that the zones could be changed.

Enclosed is information on our best available building. It is presently zoned highway commercial. This would have to be changed to industrial.

There is a good supply of grain in Park County. Within a 50 mile radius of Livingston, 8,700 acres of barley is grown, yielding 362,000 bushels. There are 11,700 acres of wheat, yielding 431,000 bushels. There is also 14,000 acres of oats yielding 8,500 bushels.

I hope that this will be of some help to you.

Sincerely,

Marc Montgomery
Executive Director
Livingston Chamber of Commerce

RECREATION FOR ONE AND ALL: WINTER, SUMMER, SPRING AND FALL.

(406) 222-0850 • P.O. BOX 660 • LIVINGSTON • MONTANA • 59047

EXHIBIT F

DIAGRAM OF A PROPOSED ANACONDA INTEGRATED INDUSTRY CONCEPT

EXHIBIT F

DIAGRAM OF A PROPOSED ANACONDA INTEGRATED INDUSTRY CONCEPT

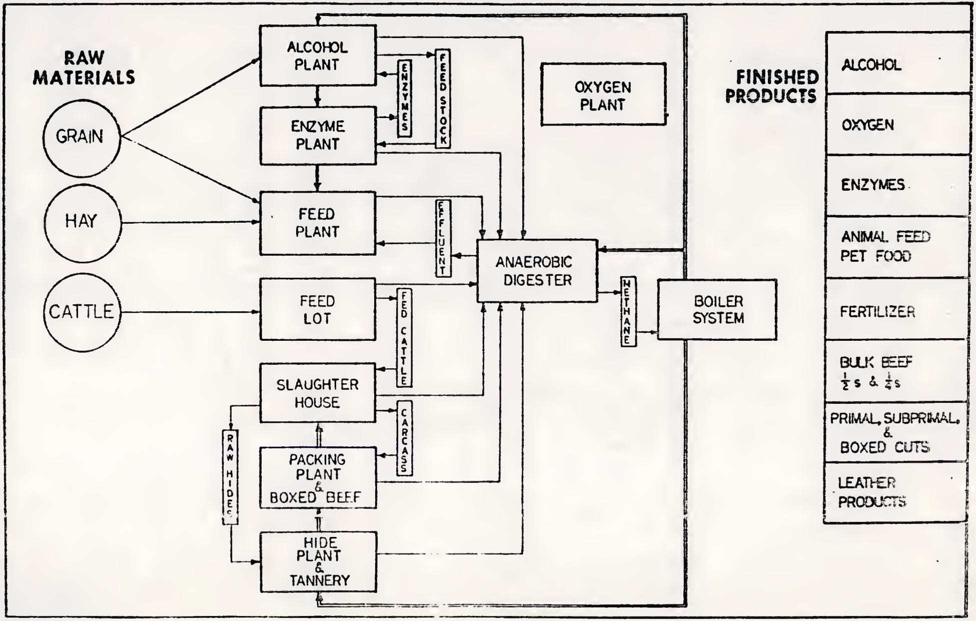


EXHIBIT G

PLANT AND EQUIPMENT COSTS
(Taken from Contract DNRC 451-811, Volume II, June 1982)

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PLANT AND EQUIPMENT COSTS

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FUEL ETHANOL PRODUCTION FROM WOOD WASTE
PLANT CAPITAL ESTIMATE SUMMARY

ACCOUNT	DESCRIPTION	SECTION	MATERIALS	LABOR	SUBCONTRACT
100-0	Equipment				
	Wood Handling and Storage	A	$ 303,642	$ 59,295	
	Steam Pretreatment	B			$1,800,000
	Digestion	C	707,052	40,236	26,000
	Chemical By-Products	D	236,922	16,200	
	Neutralization	E	423,329	24,210	
	Fermentation	F	667,361	64,920	
	Distillation	G	618,516	34,620	
	Sugar By-Product Recovery	H	509,944	18,000	
1-0	Land, Buildings	I			1,358,100
2-0	Site Improvements	I			108,258
3-0	Concrete Pads	I			378,455
5-0	Miscellaneous Structural Steel	I			48,980
15-0	Mechanical	I			989,333
16-0	Electrical	I			156,201
100-0	Boilers/Coal Handling	I	1,232,701	23,359	
	SUBTOTAL		4,699,467	280,840	4,865,327
	10% Profit and Administration		469,947	28,084	486,533
	Labor Indirect @ 45%			126,378	
	Freight (1,758,000 lb) @ 12.50 cwt		219,750		
	ELEMENT SUBTOTAL		5,389,164	435,302	5,351,860
	Plant Design @ 6% Total				670,580
	ELEMENT SUBTOTAL		5,389,164	435,302	6,022,440
	PLANT TOTAL		11,846,906		

ESTIMATE SUMMARY

MULTITECH

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE

100-0 Equipment
Wood Handling, Storage and Reclaim
Section A

ESTIMATE NO
SHEET NO. S-1
PREPARED BY J. Richards DATE 10/81
CHECKED BY DATE

MAIN ACCOUNT	DESCRIPTION	QUANTITY	MATERIALS		LABOR				SUB-CONTRACT		TOTAL
			UNIT PRICE	AMOUNT	UNIT M H	TOTAL M H	RATE	AMOUNT	UNIT PRICE	AMOUNT	
100-0	Cleaning Pond	1 each	11,100	11,100	75	75	143	10,725			
	Primary Shredder	1 each	58,500	58,500	158	158	30	4,740			
	Secondary Shredder	1 each	36,355	36,355	86	86	30	2,580			
	Vibrating Screen	1 each	11,518	11,518	34	34	30	1,020			
	Drag to 1" Hog Conveyor	1 each	26,669	26,669	249	249	30	7,470			
	Screen to Storage Conveyor	1 each	26,669	26,669	249	249	30	7,470			
	Storage to Digester Conveyor	1 each	26,669	26,669	249	249	30	7,470			
	1^o Hog to Screen Conveyor	1 each	12,859	12,859	118	118	30	3,540			
	Screen to 2^o Hog Conveyor	1 each	12,859	12,859	118	118	30	3,540			
	Screen to 1" Hog Conveyor	1 each	12,859	12,859	118	118	30	3,540			
	Drag Chain	1 each	67,585	67,585	240	240	30	7,200			
	Subtotal			303,642				59,295			
	Freight	115,000 lb									

ESTIMATE SUMMARY

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE

100-0 Equipment
Steam Pre-Treatment

Section B

ESTIMATE NO
SHEET NO S-2
PREPARED BY J. Richards DATE 10/81
CHECKED BY DATE

MAIN ACCOUNT	DESCRIPTION	QUANTITY	MATERIALS		LABOR				SUB-CONTRACT		TOTAL
			UNIT PRICE	AMOUNT	UNIT M H	TOTAL M H	RATE	AMOUNT	UNIT PRICE	AMOUNT	
100-0	Steam Pre-Treatment										
	Vendor Quote	2 each							900,000	1,800,000	
	Subtotal									1,800,000	
	Total Freight Weight	(included)									

ESTIMATE SUMMARY

MULTITECH

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE

100-0 Equipment
Digestion

Section C

ESTIMATE NO
SHEET NO S-3
PREPARED BY J. Richards DATE 10/81
CHECKED BY DATE

MAIN ACCOUNT	DESCRIPTION	QUANTITY	MATERIALS		LABOR				SUB-CONTRACT		TOTAL
			UNIT PRICE	AMOUNT	UNIT M H	TOTAL M H	RATE	AMOUNT	UNIT PRICE	AMOUNT	
100-0	Digesters	4 each		397,953	60	240	30	7,200			
	Tanks	9 each		33,396	40	360	30	10,800			
	Digester Water Heater	1 each		21,203	24	24	30	720			
	Condenser	1 each		17,300	18	18	30	540			
	Condenser with Vent Cond.	1 each		18,520	20	20	30	600			
	Flash Condenser	1 each		40,310	32	32	30	960			
	Storage Tanks	3 each		42,506		126	30	3,780			
	Pumps	7 each		14,813		162	18	2,916			
	Bucket Conveyor	1 each		15,169	80	80	30	2,400			
	SO_2 Scrubber	1 each		4,710	8	8	30	240			
	Hogged Fuel Storage Bin	1 each								26,000	
	Cyclones	2 each		12,576	40	80	30	2,400			
	Acid Dilution Mixer/Feeder	1 each		5,596	16	16	30	480			
	Dewatering Press	1 each		83,000		240	30	7,200			
	Subtotal			707,052				40,236		26,000	
	Total Freight Weight	263,000 lb									

ESTIMATE SUMMARY

MULTITECH

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE

100-0 Equipment
Chemical By-Product Processing

Section D

ESTIMATE NO
SHEET NO. S-4
PREPARED BY J. Richards DATE 10/81
CHECKED BY DATE

MAIN ACCOUNT	DESCRIPTION	QUANTITY	MATERIALS		LABOR				SUB-CONTRACT		TOTAL
			UNIT PRICE	AMOUNT	UNIT M H	TOTAL M H	RATE	AMOUNT	UNIT PRICE	AMOUNT	
100-0	Methanol Column	1 each		$43,683	40	+2,010	30	3,210			
	Furfural Column	1 each		43,683	40	+2,010	30	3,210			
	Overhead Condenser	1 each		11,400	12	12	30	360			
	Overhead Condenser	1 each		18,450	18	18	30	540			
	Vent Condeners	2 each	$ 5,290	10,580	12	24	30	720			
	Reboilers	2 each	21,203	42,406	24	48	30	1,440			
	Pump Surge Tanks	2 each	4,356	8,712	40	80	30	2,400			
	Pumps	4 each	2,001	8,004	22	88	30	2,640			
	Me OH Storage Tank	1 each		22,950	26	26	30	780			
	Furfural Storage Tank	1 each		27,054	30	30	30	900			
	Subtotal			236,922				16,200			
	Total Freight Weight	65,000 lbs									

ESTIMATE SUMMARY

MULTITECH

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE

100-0 Equipment
Neutralization

Section E

ESTIMATE NO
SHEET NO S-5
PREPARED BY J. Richards DATE 10/81
CHECKED BY DATE:

MAIN ACCOUNT	DESCRIPTION	QUANTITY	MATERIALS		LABOR				SUB-CONTRACT		TOTAL
			UNIT PRICE	AMOUNT	UNIT M H	TOTAL M H	RATE	AMOUNT	UNIT PRICE	AMOUNT	
100-0	Concentrated Sugar Soln. Tank	1 each		$ 71,602	80	80	30	$ 2,400			
	Dilute Sugar Soln. Tank	1 each		31,208	48	48	30	1,440			
	Sugar Soln. Tank	1 each		71,602	80	80	30	2,400			
	Pumps	6 each		22,438		144	30	4,320			
	Cascade and Sand Filter	1 each		130,000		240	30	7,200			
	Centrifugal Separator	1 each		90,000	80	80	30	2,400			
	Lime Storage Bin	1 each		779				450			
	In-line Mixers	2 each		3,000		80	30	2,400			
	Tubular Conveyor & Hopper	1 each		2,700		40	30	1,200			
	Subtotal			423,329				24,210			
	Total Freight Weight	180,000 lbs.									

MULTITECH

ESTIMATE SUMMARY

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE

100-0 Equipment
Fermentation

Section F

ESTIMATE NO
SHEET NO S-6
PREPARED BY J. Richards DATE 10/81
CHECKED BY DATE

MAIN ACCOUNT	DESCRIPTION	QUANTITY	MATERIALS		LABOR				SUB-CONTRACT		TOTAL
			UNIT PRICE	AMOUNT	UNIT M H	TOTAL M H	RATE	AMOUNT	UNIT PRICE	AMOUNT	
100-0	Pumps	8 each		$ 27,416		240	$30	$ 7,200			
	Fermentation Tanks	6 each	27,281	163,686	80	480	30	14,400			
	Beer Storage Tanks	2 each	27,281	54,562	80	160	30	4,800			
	Small Tanks	4 each	14,471	57,884	40	160	30	4,800			
	Agitators	12 each	5,600	67,200	32	384	30	11,520			
	Sugar Soln. Cooler	1 each		26,613	20	20	30	600			
	Centrifugal Separators	3 each	90,000	270,000	240	720	30	21,600			
	Subtotal			667,361				64,920			
	Total Freight Weight	490,000 lbs.									

ESTIMATE SUMMARY

MULTITECH

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE

100-0 Equipment
Distillation

Section G

ESTIMATE NO
SHEET NO S-7
PREPARED BY J. Richards DATE 10/8
CHECKED BY DATE

MAIN ACCOUNT	DESCRIPTION	QUANTITY	MATERIALS UNIT PRICE	MATERIALS AMOUNT	LABOR UNIT M H	LABOR TOTAL M H	LABOR RATE	LABOR AMOUNT	SUB-CONTRACT UNIT PRICE	SUB-CONTRACT AMOUNT	TOTA
100-0	Equipment Subtotal (Vendor Quote)	All	$545,000	545,000	1,000	1,000	$ 30	$ 30,000			
	Ethanol Storage Tanks	2 each	34,384	68,768	65	130	30	3,900			
	Ethanol Transfer Pump	1 each	4,748	4,748	24	24	30	720			
	Subtotal			618,516				34,620			
	Total Freight Weight	212,000 lbs.									

ESTIMATE SUMMARY

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE

100-0 Equipment
Sugar By-Product Recovery

Section H

ESTIMATE NO
SHEET NO S-8
PREPARED BY J. Richards DATE 10/81
CHECKED BY DATE

MAIN ACCOUNT	DESCRIPTION	QUANTITY	MATERIALS		LABOR				SUB-CONTRACT		TOTAL
			UNIT PRICE	AMOUNT	UNIT M H	TOTAL M H	RATE	AMOUNT	UNIT PRICE	AMOUNT	
100-0	Pumps with Drivers	6 each		$ 25,886		152	$30	$ 4,560			
	Evaporator/Steam Compressor	2 each		246,041		160	30	4,800			
	Condensor	1 each	$16,300	16,300		18	30	540			
	Flash Drums	2 each	4,356	8,712	40	80	30	2,400			
	Thin Stillage Tank	1 each		52,015	30	30	30	900			
	Concentrated Solution Tank	1 each		97,375	88	88	30	2,640			
	Pre-heater	3 each	21,205	63,615	24	72	30	2,160			
	Subtotal			509,944				18,000			
	Total Freight Weight	173,000 lbs.									

ESTIMATE SUMMARY

MULTITECH

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE

General Accounts Section I

ESTIMATE NO

SHEET NO. S-9

PREPARED BY J. Richards DATE 10/81

CHECKED BY DATE

MAIN ACCOUNT	DESCRIPTION	QUANTITY	MATERIALS		LABOR				SUB-CONTRACT		TOTAL
			UNIT PRICE	AMOUNT	UNIT M H	TOTAL M H	RATE	AMOUNT	UNIT PRICE	AMOUNT	
1-0	Land								$ 103,500		
	Buildings								753,600		
	Loaders								501,000		
	Subtotal								$	1,358,100	
2-0	Earth Work								44,352		
	Water Distribution								20,826		
	Asphalt								17,520		
	Settling Ponds								25,560		
	Subtotal									108,258	
3-0	Concrete Pads								378,455		
	Subtotal									378,455	
5-0	Misc. Structural Steel								48,980		
	Subtotal									48,980	
15-0	Sewage and Drainage								16,185		
	Process Piping								814,720		
	Instrumentation & Control								150,762		
	Pipe Hangers & Supports								7,666		
	Subtotal									989,333	
16-0	Power Distribution								130,361		
	Instrumentation Wiring								25,840		
	Subtotal									156,201	

ESTIMATE SUMMARY

MULTITECH

PROJECT: FUEL ETHANOL PRODUCTION FROM WOOD WASTE

100-0 Equipment — General Accounts

Boilers, Coal Handling — Section I

ESTIMATE NO.

SHEET NO. S-10

PREPARED BY: J. Richards DATE: 10/8

CHECKED BY: DATE:

MAIN ACCOUNT	DESCRIPTION	QUANTITY	MATERIALS		LABOR				SUB-CONTRACT		TOTA
			UNIT PRICE	AMOUNT	UNIT M.H.	TOTAL M.H.	RATE	AMOUNT	UNIT PRICE	AMOUNT	
100-0	Boilers	5 each	240,000	$1,200,000	80	400	$ 30	$ 12,000			
	R. R. Unloading Hopper	1 each	1,352	1,352				836			
	Swing Belt Conveyors	2 each	12,859	25,718	118	236	30	7,080			
	Stoker Bin Feeders	1 each	5,631	5,631				3,443			
	Subtotal			1,232,701				23,359			
	Freight	260,000 lbs.									

QUANTITY SURVEY

MULTITECH

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE SECTION A
ACCOUNT
100-0 Equipment
Wood Handling, Storage and Reclaim

ESTIMATE NO
SHEET NO A-1 of 5
PREPARED BY J. Richards DATE 10/81
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	WIDTH	LENGTH	HEIGHT/ DEPTH	CAPACITY	SPEED	DRIVE H. P.		
3-0	Cleaning Pond	1 each	40'	20'	10'	60,000 gal.				
100-1	Drag Chain	1 each		70'		40T/Hr				
100-1	Conveyors	7 each								
	Drag to Primary Hog		30"	100'	10'	40T/Hr	100 FPM	5		
	Primary Hog to Screen			30'		40T/Hr	100 FPM			
	Screen to Secondary Hog			30'	5'	40T/Hr	100 FPM			
	Screen to 1^{o} Hog			30'		40T/Hr	100 FPM			
	2^{o} Hog to Storage		30"	100'	45'	40T/Hr	100 FPM	5		
	Storage to Digester	2 each	30"	100'	45'	40T/Hr	100 FPM	5		
N/A	Storage Area	2 each	200'	200'	Covered in Account 3-0					
N/A	Bulldozer			Covered in Account 1-0						
100-39	Primary Shredder	1 each				40T/Hr		400		
100-39	Secondary Shredder	1 each				20T/Hr		200		
100-65	Screen Shaker	1 each	3'	12'		40T/Hr				

ESTIMATE WORK SHEET

PROJECT: FUEL ETHANOL PRODUCTION FROM WOOD WASTE

100-0 Equipment
Wood Handling, Storage, and Reclaim - Cleaning Pond, Shredders, Screen Separator

ESTIMATE NO
SHEET NO. A-2 of 5
PREPARED BY J. Richards DATE 10/81
CHECKED BY: DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
3-0	Cleaning Pond	1 ea.					
3-10	Gang formed concrete walls 12" thick heavily reinforced	75 cy	$ 148	$ 11,100			
	Installation - Labor	75 cy	143	10,725			
100-391	Primary Shredder - SH4454 40 ton, 900 RPM, 40 TPH	1 ea.	50,300	50,300	19,000	19,000	96 MH Installation
	400 HP - NEMA A, Class F, TEFC Block 5	1 ea.	8,200	8,200			62 MH
	Total Primary Shredder			58,500		19,000	
	Installation - Labor	158 MH	$30/hr	4,740			
100-391	Secondary Shredder - SH3640 1,200 RPM, 20 TPH	1 ea.	30,600	30,600		10,000	48 MH
	200 HP - NEMA A, Class B, TEFC Block 5	1 ea.		5,755			38 MH
	Total Secondary Shredder			36,355		10,000	
	Installation - Labor	86 MH	$30/hr	2,580			
100-65	Vibrating Screen V-700 3 x 12	1 ea.	10,900	10,900	3,600	3,600	28 MH
	5 HP - NEMA A, Class B, TEFC Explosion Proof, Block 6	1 ea.	618	618			6 MH
	Total Vibrating Screen			11,518			
	Installation - Labor	34 MH	$30/hr	1,020			

MULTITECH

ESTIMATE WORK SHEET

PROJECT: FUEL ETHANOL PRODUCTION FROM WOOD WASTE

100-0 Equipment

Wood Handling Storage and Reclaim - Conveyors

ESTIMATE NO

SHEET NO. A-3 of 5

PREPARED BY J. Richards DATE 10/81

CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-1	Conveyors, 30' Horizontal, 8° Rise						
	5' Vertical Dist.	3 each					
	Belt = 2 ply, RMA 105 x 30", 83 fpm	65 each	$ 20.7	$ 1,346	4.5	293	4 MH Installation
	Mechanical Splice Kit	2 each	89	178			8 MH Installation
	Head Pulley, Drive & Drive	1 each		3,215		850	6 MH Installation
	Tail Pulley (Gravity Take-up)	1 each		720		650	2 MH Installation
	Snub and Bend Pulleys	1 each		465		140	2 MH Installation
	Trough Pulleys	8 each	185	1,480	62	496	32 MH Installation
	Return Idlers	3 each	85	255	33	99	12 MH Installation
	2' - 0 Truss	30 feet	38	1,140	35	1,050	9 MH Installation
	A-Frame Supports	2 each	500	1,000	395	790	6 MH Installation
	Conveyor	3 each	415	1,245	468	1,404	9 MH Installation
	Loading Hopper	1 each		230		250	2 MH Installation
	Discharge Hood	1 each		485		550	4 MH Installation
	3 H.P. Nema, TEFC, Class B, Block 5			1,100		400	22 MH Installation
	Total Conveyor	1 each		12,859		6,972	
	Installation Labor	118 m.h.	30	3,540			
	Total 30' Conveyors	3 each	12,859	38,577	6,972	20,916	
	Installation Labor	3 each	3,540	10,620			

ESTIMATE WORK SHEET

MULTITECH

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE

100-0 Equipment
Wood Handling, Storage, and Reclaim - Conveyors

ESTIMATE NO
SHEET NO. A-4 of 5
PREPARED BY J. Richards DATE 10/81
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-1	Conveyors, 100' Horizontal Dist. 25° Rise = 42' Vertical Dist.	3 each					
	Belt = 2 ply R.M.A. 105 x 30"w	220 feet	$20.70	$ 4,554	4.5	990	5 MH Installation
	Mechanical Splice Kit	2 each	89	178			8 MH Installation
	5 h.p. Head Pulley, Drive and Drive Guard	1 each		3,215		850	6 MH Installation
	Tail Pulley (Gravity Take-up)	1 each		720		650	4 MH Installation
	Snub and Bend Pulleys	1 each		465		140	2 MH Installation
	Trough Pulleys	22 each	185	4,070	62	1,364	88 MH Installation
	Return Idlers	10 each	85	850	33	330	40 MH Installation
	2'-0" Truss	100 feet	38	3,800	35	3,500	30
	A-Frame Supports	2 each		2,400		2,428	6
	Conveyor Frame	10 each	415	4,150	468	4,680	30
	Loading Hopper	1 each		230		250	2
	Discharge Hood	1 each		485		550	4
	5 HP Memo A, TEFC Class B	1 each		1,512		500	24 MH Installation
	Total Conveyor	1 each		26,669		16,232	
	Installation Labor	249 m.h.	30	7,470			
	Total 100' Conveyors	3 each	26,669	80,007	16,232	48,696	
	Installation Labor	3 each	7,470	22,410			

MULTITECH

ESTIMATE WORK SHEET

PROJECT: FUEL ETHANOL PRODUCTION FROM WOOD WASTE
100-0 Equipment
Wood Handling, Storage, and Reclaim - Conveyors

ESTIMATE NO
SHEET NO. A-5 of 5
PREPARED BY J. Richards DATE 10/81
CHECKED BY: DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-1, 2	Drag Chain - Joy Mfg. Co.	1 each					
	45 pounds/ft^3						
	Drive and Chain Guard	1 each	$10,910	$10,910		750	
	Head and Tail Shaft	2 each		2,215		600	
	Chain, 6670 pound maximum load	150 ft	14	16,650	15	2,250	X 3 spaced 844 chain
	Idler Pulleys	14	1,380	19,320	250	3,500	X 3 self adjusting pulleys, 42"
	Conveyor Frames	70 ft	225	15,570	70	4,900	
	25 HP Motor Class B, FEFC, NEMA Block 6	1 each		2,740		500	
	Total Drag Chain	1 each		67,585		12,500	
	Installation Labor	240 hrs	30	7,200			

QUANTITY SURVEY

MULTITECH

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE SECTION B
ACCOUNT 100-0 Equipment
Steam Pretreatment

ESTIMATE NO
SHEET NO B-1 of 2
PREPARED BY J. Richards DATE 10/81
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	RAW #/HR	STEAM #/HR	DIA.	T to T	CAP.			
100-0	Steam Pretreatment	2	14,000	7,826	30"	25'	5 tons			
	Stake Technologies with									
	Storage Bin and Conveyors									

ESTIMATE WORK SHEET

MULTITECH

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE

100-0 Equipment
Steam Pretreatment - Section B

ESTIMATE NO
SHEET NO B-2 of 2
PREPARED BY J. Richards **DATE** 10/81
CHECKED BY **DATE**

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-0	Steam Pretreatment	2	$900,000	$1,800,000	N/A		Total installed cost, freight, and labor included
	30' diameter x 25' long with hopper, feeders, and collection bins						Subcontract unit price

QUANTITY SURVEY

MULTITECH

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE SECTION C
ACCOUNT
100-0 Equipment
Digestion Section

ESTIMATE NO
SHEET NO C-1 of 13
PREPARED BY J. Richards DATE 10/81
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	DIA	T to T	PRESSURE RATING	TEMP.	MATL.	MATL. THICKNESS	CAP./ AREA	MATE. RATING
100-341	Digester	4 ea.	96"	20'-0"	250 psig	400°F	Alloy 825	3/4"		
100-341	Small Tanks (water level, pump surge, 1st stage flash drum, 2nd stage flash)	7 ea.	24"	4'-0"	75 psig	400°F	316 SS	1/2"		
100-341	Small Tanks (bypass phase separator, phase separator)	2 ea.	24"	4'-0"	75 psig	350°F	C.S.	1/2"		
100-220	Digester Water Heater	1 ea.	16"		790 psig	550°F	Alloy 20		400 ft^2	600 #
							C.S.			
100-230	Condenser	1 ea.			75 psig	100°F	Alloy 20		190 ft^2	150 #
							C.S.			
100-220	Condenser	1 ea.	14"		20 psig	400°F	Alloy 20		320 ft^2	150 #
100-230	With Vent Condenser	1 ea.					C.S.		20 ft^2	150 #
100-220	Flash Condenser	1 ea.	28"		225 psig	400°F	Alloy 20	1	220 ft^2	300 #
							C.S.			
100-341	H2SO4 Storage Tank	1 ea.	72"	12'-0"			C.S.	5/8"	9,600 gal	
100-341	Digester Water Storage Tank	1 ea.	78"	20'-0"			C.S.	5/8"	20,000 gal	
100-341	Flash Tank	1 ea.	66"	15'-0"			C.S.	5/8'	10,000 gal	
			FLOW	HEAD		MATL	DISP.	DRIVER		
100-280	Pumps									
	Acid Supply	1 ea.	5 gpm	10		C.S.	Metering	1.5 HP		
	Xfer to Dilute Storage	1 ea.	10 gpm	30		316 SS	In line	1.5 HP		
	Condensate Transfer	1 ea.	10 gpm	25		316 SS	In line	1.5 HP		
	Sludge Transfer	1 ea.	10 gpm	70		316 SS	Sewage	5.0 HP		
	Sugar Solution Transfer	1 ea.	10 gpm	30		316 SS	In line	1.5 HP		
	Digester Water	1 ea.	300 gpm	102		316 SS	In line	15.0 HP		
	Tower Feed	1 ea.	50 gpm	30		316 SS	Centr.	1.5 HP		
			DENSITY	HEIGHT	TYPE	MATL.	RATE	DRIVE		
100-2	Bucket Elevator	1 ea.	30#/ft^3	30 ft	Cont. Belt	C.S.	20 T/hr	3 HP		
100-115	S02 Scrubber	1 ea.								
	Residue Storage Bin with Feeder	1 ea								

QUANTITY SURVEY

MULTITECH

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE
ACCOUNT
100-0 Equipment
Digestion

ESTIMATE NO
SHEET NO C-2 of 13
PREPARED BY J. Richards DATE 10/81
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	DIA.	T to T	MATL.	THICK.	CAPAC.	HP	FLOW	
100-0	Residue Cyclone									
	2' diameter x 4' drum 316 SS	2 ea.	24"	4'	316 SS	1/2"				
	From Page A-2									
	Acid Dilution Mixer				304 SS		500 gal		20.8 gph	
	Dewatering Press						2 ton/hr			

MULTITECH

ESTIMATE WORK SHEET

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE

100-0 Equipment
Digestion

ESTIMATE NO
SHEET NO C-3 of 13
PREPARED BY J. Richards DATE 10/81
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-341	Digesters	4 ea					
100-342 pg. 8	Shell Alloy 825 100% X-rayed 3/4" thick material, no stress relief	80 ft	$ 1,484	$118,720	775.1#	62,008 #	4 times A-285 C.S. prices
100-342 pg. 8	Semi Eliptical Heads 2 for each Alloy 825, 100% X-rayed 3/4" thick material	4 sets	20,064	80,256	5,496	21,484	4 times A-285 C.S. prices
100-344 pg. 1	Angle Legs for Vertical Vessels,	16 ea.	92	1,472	80#	1,280#	6" x 6" 1/2" C.S. 4' lon
	Base plates for legs	16 ea.			20.5#	328	8-1/2" x 8-1/2" x 1" C.S
100-347	Buttweld Flange Type Nozzles						All flanges 600# R. F. Buttweld, 4 times A-105 prices
	2" 2 per hydrolyzer 600#	8 ea.	146	1,168	17	136	
	4" 2 per hydrolyzer 600#	8 ea.	271	2,168	59	472	
	18" 1 per hydrolyzer 600#	4 ea.	7,144	28,576	763	3,052	
100-356	Ladder Support Clips	80 ft	32.56	2,605			
5-11	Platforms Ladders and Handrails						
	Uncaged ladder	40 ft	14.0	560	10	400	
	Caged Ladder	280 ft	25.20	7,056	18	5,040	
	Circular Platform 3/16" x 1"	76 ft	140.00	10,640	100	7,600	
	Handrails	76 ft	28.00	2,128	20	1,520	
100-0	Miscellaneous (lifting lugs, trays if applicable)	4 ea.	35,651	142,604	11,545	46,180	
100-0	Digester Total	4 ea	99488.2	$ 397,953	37,500	150,000	
	Installation Labor	4 ea.	60 hrs	240 hrs	30	$ 7,200	Composite crew rate and crane time based on 19 tons weight for each unit.

ESTIMATE WORK SHEET

PROJECT: FUEL ETHANOL PRODUCTION FROM WOOD WASTE

Digestion - Small Tanks

ESTIMATE NO

SHEET NO. C-4 of 13

PREPARED BY J. Richards DATE 10/8

CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-341	Small Tanks Stainless Steel 316	7 ea.					Stainless Steel 316 price 3 times C.S. A-285
	Small Tanks Carbon Steel A-285	2 each					
100-342	C.S. Shell x 3, 316 SS, 100% X-rayed 1/2" material, 24" diameter	4'	303	1,212	130.97	524	Price for supports equals 2 times
100-342	C.S. S. E. Heads x 3 316 SS 100% X-rayed, 1/2" material	Pair	966	966	143.	143	
	Miscellaneous (support equipment, etc.)	AR		2,178	6	667	
	Total One Tank			4,356		1,334	
	Total S.S. Small Tank	7 ea.	4,356	30,492	1,334	9,338	
100-342 pg. 2	C.S. A-285 Shell, 100% X-rayed 1/2" material 24 " diameter	4	101	404	131	524	
100-342	C.S. S. E. Heads 100% X-rayed, 1/2" material	Pair	322	322	143	143	
	Miscellaneous	AR	726	726	667	667	
	Total One Tank			1,452		1,334	
	Total C. S. Small Tanks		1,452	2,904	1,334	2,668	
	Total Small Tanks	9 ea.		33,396		12,006	
	Installation Labor	9 ea.	40 hrs	360 hrs	$30.00	$10,800	Composite crew and cran time based on 40 hours total time each drum

MULTITECH

ESTIMATE WORK SHEET

PROJECT: FUEL ETHANOL PRODUCTION FROM WOOD WASTE

Digestion - Water Heater

ESTIMATE NO

SHEET NO. C-5 of 13

PREPARED BY J. Richards DATE 10/81

CHECKED BY: DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-220	Digester Water Heater	1 ea.					
	TEMA R Shell and Tube Heat Exchanger	400 ft^2			14#/ft^2	5,600	
	Type BEU, 600 # rating						
100-220	16" Exchanger Shell Diameter	1 ea.	$ 4,676	$ 4,676			
pg. 2	Base Price, Carbon Steel						
pgs. 3-4	Front and Rear Heads	2 ea.	N/C	N/C			
pg. 6	16" Shell, 10' Bundle Length	10 ft.	128	1,280			
pg. 7	4" Nozzle ANSI 600#	1 ea.	251	251			
	1-1/2" Coupling 600#	1 ea.	45	45			
pg. 8	U-Tubes, Alloy 20, 3/4" Size	90 ea.	$6.94	625			4/3 times 316 SS
	No. of Tubes						
	Heating Surface Area	400 ft^2	22.40	8,960			
pg. 9	Support Saddles and Lifting Lugs	4 ea.	172	688			
	Longitudinal Baffles	400 ft^2	11.07	4,428			
	ASME Code Stamp and Data Sheets			250			
	Total Digester Water Heater	1 ea.		$21,203		5,600	
	Installation Labor	24 hrs	$30/hr	720			Based on tonnage, crew and crane

ESTIMATE WORK SHEET

MULTITECH

PROJECT: FUEL ETHANOL PRODUCTION FROM WOOD WASTE

Digestion - Residue Flash Condenser

ESTIMATE NO

SHEET NO. C-6 of 13

PREPARED BY J. Richards DATE 10/8

CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-230	Condenser						
	Model 85-F, Stokes Inc. Vertical tube surface condenser and receiver, vacuum type	1 ea	$12,300	$12,300		1,850	
	Modify using Alloy 20 tubes			5,000			
	Total - Condenser			17,300		1,850	
	Installation labor	18 mh	$30/hr	540			

ESTIMATE WORK SHEET

MULTITECH

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE

Digestion - Second Stage Flash Condenser

ESTIMATE NO

SHEET NO. C-7 of 13

PREPARED BY J. Richards DATE 10/81

CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-220	Condenser	1 ea. 320 ft^2			10	3,200	
	with vent condenser	20 ft^2		$ 2,470		700	
	Alloy 20 tubes, carbon steel shell 150# rating						
100-220 pg. 2	Basic shell 14" diameter carbon steel	1 ea.	$ 3,210	3,210			
	Front and rear heads	2 ea.		N/C			
	Shell 14", 10' bundle length	10 ft.	87	870			
	2" Nozzle	1 ea.	91	91			
	1" Coupling	1 ea.	24	24			
	U-Tubes, Alloy 20, 3/4" size	100 tubes	5.94	594			
	Cooling Area Alloy 20	320 ft.	22.40	7,168			
	Support Saddles & Lifting Lugs	2 ea.	150	300			
	Longitudinal Baffles	320 ft	11.07	3,543			
	ASME Code Stamp			250			
	Total Condenser			$18,520		3,900	
	Installation - Labor	20 mh	$30/hr	600			

ESTIMATE WORK SHEET

MULTITECH

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE

Digestion - First Stage Flash Condenser

ESTIMATE NO

SHEET NO. C-8 of 13

PREPARED BY J. Richards DATE 10/8

CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-220	Flash Condenser	1 ea.					
	300#, Alloy 20 tubes C. S. shell	1,220 ft^2			9	10,980	
100-220 pg. 2	Basic Shell diameter	28"	$ 7,190	$ 7,190			
	Shell 10' 140#	10"	161	1,610			
	Front and rear heads			N/C			
	2" Nozzle 300#	1 ea.	95	95			
	6" Nozzle 300#	1 ea.	299	299			
	8" Nozzle 300#	2 ea.	367	734			
	3/4" U-Tubes, 300#	250	6.36	1,590			4/3 times 316 SS
	Alloy 20	1,220 ft^2	22.40	27,328			
	Support Plates	4	190	760			
	Support Saddles	2	227	454			
	ASME Stamp and Data Sheets			250			
	Total - Flash Condenser			$40,310		10,980	
	Installation Costs	32 mh	$ 30/hr	960			Based on tonnage, crew and crane time.

ESTIMATE WORK SHEET

PROJECT: FUEL ETHANOL PRODUCTION FROM WOOD WASTE

Digestion - Storage

ESTIMATE NO

SHEET NO. C-9 of 13

PREPARED BY J. Richards DATE 10/

CHECKED BY: DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-341	H_2SO_4 Storage Tank, Carbon Steel	1 ea.					
	72" x 12'-0" Shell - 5/8" thick	1 ea.	$ 259	$ 3,108	485	5,820	
	2 S.E. Heads	2 ea.		3,039	1,323	2,646	
	All Others	AR		6,147		4,233	
	Total H_2SO_4, Storage Tank			12,294		12,700	Use 7 tons
100-341	Hydrolyzer Water Storage Tank	1 ea.					
	78" x 20'-0" - 5/8" thick	1 ea.	270	5,400	525	10,500	
	2 S.E. Heads	2 ea.		3,406	1,545	3,090	
	All Others	AR		8,806			
	Total Hydrolyzer Water Storage Tank			17,612		20,385	Use 11 tons
100-341	Flash Tank	1 ea.					
	66" x 15' - 5/8" thick	15'	243	3,645	445	6,675	
	2 S.E. Heads	2 ea.		2,655	1,119	2,238	
	All Others	AR		6,300		4,457	
	Total Flash Tank			12,600		13,370	Use 7 tons
	Total All Storage Tanks			42,506			
	Installation - Labor	126 mh	$30/hr	3,780			
							Working hypothesis 2 x shell and head pric
							Labor based on tonnage, crew, and crane time

ESTIMATE WORK SHEET

MULTITECH

PROJECT: FUEL ETHANOL PRODUCTION FROM WOOD WASTE

Digestion - Pumps

ESTIMATE NO

SHEET NO. C-10 of 13

PREPARED BY J. Richards DATE: 10/81

CHECKED BY: DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-310	Acid Supply Pump						All motors for chemical
	(Chemical Metering) 60 G.P.H.	1 ea		$ 1,955			service, chemical
100-652	1-1/2 HP Motor	1 ea.		296			metering pump
100-286	Dilute Storage Transfer Pump						
	10 gpm 316 SS 30 ft head	1 ea.		1,705			In-line, centrifugal
100-652	1-1/2 HP motor	1 ea.		296			
100-286	Condensate Transfer						
	10 gpm 316 SS 25 ft head	1 ea.		1,705			In-line, centrifugal
100-652	1-1/2 HP motor	1 ea.		296			
100-305	Sludge Transfer Cast Iron Sewage Pump						
	10 gpm 70 ft	1 ea.		1,130			Sewage Pump
100-652	5 HP motor	1 ea		378			
100-286	Sugar Solution Transfer, In-Line						
	10 gpm 316 SS 30 ft head	1 ea.		1,705			In-line centrifugal
100-652	1-1/2 HP motor	1 ea.		296			
100-286	Digester Water Feed Pump						
	300 gpm 316 SS 102 ft head	1 ea.		2,820			In-line centrifugal
100-652	15 HP motor, chemical service	1 ea.		810			
100-280	Tower Feed, Vertical Centrifugal Pump						
	50 gpm 316 SS 30 ft head	1 ea		1,125			Vertical, S.S. Centrifu
100-652	1-1/2 HP motor	1 ea.		296			
	Total Pumps and Motors	7 ea.		14,813		2,800	
	Installation - Labor	162 mh		$ 2,916			

ESTIMATE WORK SHEET

PROJECT: FUEL ETHANOL PRODUCTION FROM WOOD WASTE

Digestion - Bucket Elevator

ESTIMATE NO

SHEET NO. C-11 of 13

PREPARED BY J. Richards DATE 10/81

CHECKED BY: DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-2	Bucket Elevator, Continuous Belt Size VCB-23	1 ea.					
pg. 7	Drive and V-Belt Guard, 27 rpm 3 HP	1 ea.	$ 1,870	$ 1,870	250	250	4 MH
pg. 9	Head Shaft and Tail Shaft	1 ea.	2,830	2,830	425	425	5 MH
pg. 10	Buckets - 24" x 8" x 3/16"	20 ea.	44.30	886	40	800	8 MH
pg. 10	Belt - 26" 105 nylon 6 ply	66 ft.	45.70	3,017			8 MH
	Belt Splicing Kit	2 ea.	86	172			6 MH
pg. 13	Elevator Casings						
	Head Section	1 ea.	750	750	650	650	2 MH
	Tail Section	1 ea.	840	840	730	650	3 MH
	Std. Section	2 ea.	1,445	2,890	1,260	2,520	12 MH
	Filter Section	6 ft.	121	726	105	630	6 MH
100-653	NEMA A, TEFC Explosion-Proof 3 HP, Class B Insulation Motor	1 ea.	1,188	1,188			22 MH
	Total Bucket Elevator			15,169		6,000	
	Installation - Labor	80 MH	$30/hr	2,400			Includes crane and crew rate

MULTITECH

ESTIMATE WORK SHEET

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE
100-0 Equipment
Digestion - SO2 Scrubber

ESTIMATE NO
SHEET NO. C-12 of 13
PREPARED BY J. Richards DATE 10/81
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-115	SO_2 Scrubber, Size WH-65 Q = 4,000 CFM N - 250 55"10 C Pressure Drop R - 1 - 4.8 - 13 Say 9 R - 2 = .45 - 1.8 Say 1.13 R - 3 = .75 W - 1 = 36 W - 7 - 7.52 1/4" 304 SS Construction	1 ea	$ 4,710	$ 4,710	35	35	
	Installation - Labor	8 MH	$30/hr	240			
100-373	Residue Storage Bin Subcontract Unit Price	1 ea	$26,000	$ 26,000			Concrete double sloping 100 ton capacity includes labor

MULTITECH

ESTIMATE WORK SHEET

PROJECT: FUEL ETHANOL PRODUCTION FROM WOOD WASTE
100-0 Equipment
Digestion

ESTIMATE NO
SHEET NO. C-13 of 13
PREPARED BY J. Richards DATE 10/81
CHECKED BY: DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-341	Cyclone						
	2" Diameter x 4' T to T 316 SS	2 ea.	$ 6,288	$ 12,576	1,215	2,430	
	Installation - Labor	2 ea.	40 MH	80 MH	$30/hr	2,400	
100-135	Acid Dilution Mixer/Feeder Package	1 ea.	5,596	5,596	881	881	
	Unit 500 gal. 304 SS, 20.8 gph						
	Installation - Labor	16 hrs.	$30/hr	480			
100-0	Dewatering Press	1 ea	83,000	83,000		20,000	
	Vendor 2 ton/hr						
	1 M wide						
	Installation - Labor	240 MH	$30/hr	7,200			

QUANTITY SURVEY

MULTITECH

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE SECTION D
ACCOUNT
100-0 Equipment
Chemical By-Product Processing

ESTIMATE NO
SHEET NO D-1 of 5
PREPARED BY J. Richards DATE 10/8
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	DIA.	T to T	PRESS.	TEMP.	MATL.	MATL. THICKNESS	CAP. AREA	MATL. RATING
100-341	Methane Recovery - Column	1 each	18"	45'-0"	50 psi	400°F	316 SS	1/2"		
100-341	Furfural Recovery Column	1 each	24"	45'-0"	50 psi	400°F	316 SS	1/2"		
100-230	Condenser	1 each			50 psi	400°F	316 SS/ C.S.		50 ft^2	
100-230	Condenser	1 each			50 psi	400°F	316 SS/ C.S.		150 ft^2	
100-230	Vent Condenser	2 each							50 ft^2	
100-220	Reboiler	1 each			50 psi	400°F	Alloy 20/C.S.			
100-220	Reboiler	1 each			50 psi	400°F	Alloy 20/C.S.			
100-341	Pump Surge Tank	2 each	24"	4'-0"	50 psi		316 SS	3/8"		
100-286	Pumps		FLOW	HEAD		MATL.	TYPE	DRIVE		
	Methane Reflux	1 each	5 gpm	65'		316 SS	in-line	1-1/2 HP		
	Methane Storage	1 each	5 gpm	35'		316 SS	in-line	1-1/2 HP		
	Furfural Reflux	1 each	5 gpm	70'		316 SS	in-line	1-1/2 HP		
	Furfural Storage	1 each	5 gpm	70'		316 SS	in-line	1-1/2 HP		
	Methane Storage Tank	1 each	6'	12'		316 SS		5/8"		
	Furfural Storage Tank	1 each	6'	12'		316 SS		5/8"		

ESTIMATE WORK SHEET

MULTITECH

PROJECT: FUEL ETHANOL PRODUCTION FROM WOOD WASTE

100-0 Equipment

Chemical By-Product Processing - Recovery Columns

ESTIMATE NO

SHEET NO. D-2 of 5

PREPARED BY J. Richards DATE 10/81

CHECKED BY: DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-341	Methanol Recovery Column	2 ea.					Note: Estimate for 18"
							diameter pressure vesse
	Furfural Recovery Column						are non-existant use
							24" diameter. Use
100-342	Shell - 1/2" 316 SS x 3 C.S.	45"	$ 303	$ 13,635	131	5,895	this estimate for both
							recovery columns
100-342	Semi-Eliptical Heads	2 ea.	1,932	1,932	286	286	
100-344	Angle Legs 6" x 6" x 1/2"	4 ea.	92	368	80	320	
	Base Plates 8-1/2" x 8-1/2" x 1"						
100-347	Buttweld Nozzles						
	2" R.F. 150#	2 ea.	267	534	14	28	
	4" R.F. 150#	1 ea.	600	600	31	31	
	6" R.F. 150#	2 ea.	765	1,530	57	114	
100-352	Tray Support Rings	30 ea.	426	12,780	22	660	Tray installation
							67 x 30 - 2,010
100-359	Removable Type Trays	30 ea.	295	8,850	60	1,800	Use 3 ft. diameter
100-359	Ladder, Platform, and Support Clips	45 ea.	22	990			
	Lifting Lugs			210			
5-11	Caged Ladders and Circular Platform	1,610 lbs.	$ 1.40	2,254	1,610		
							Use 6 tons
	Total Methanol Recovery Column	1 ea.	43,686	43,683	11,000		
	Total Furfural Recovery Column	1 ea.	43,683	43,683	11,000		
	Installation - Labor	80 MH	30	2,400			Crane and crew rate
	Tray Installation	60 trays	67	4,020			$30/MH
	Total Recovery Columns	2 ea.		87,366	22,000		
	Total - Labor			6,420			

MULTITECH

ESTIMATE WORK SHEET

PROJECT: FUEL ETHANOL PRODUCTION FROM WOOD WASTE

100-0 Equipment

Chemical By-Product Processing - Condensers

ESTIMATE NO

SHEET NO. D-3 of 5

PREPARED BY J. Richards DATE 10/

CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-230	Condenser A = 50 ft^2						
	Type 85-CD x 3/2 for 316 SS	1 each	11,400	11,400	1,050	1,050	12 mh
100-230	Condenser A = 150 ft^2	1 each	18,450	18,450	1,850	1,850	18 mh
	Type 85-E x 3/2 for 316 SS						
100-230	Vent Condensers A = 43 ft^2	2 each	5,290	10,580	700	1,400	2 x 12 mh
	Type 85-BS						
	Total Condensers	4 each		40,430		4,300	
	Installation Labor	54	30	1,620			

ESTIMATE WORK SHEET

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE

100-0 Equipment

Chemical By-Product Processing - Bottoms Reboilers/Reflux Level Drums/ Pumps

ESTIMATE NO

SHEET NO D-4 of 5

PREPARED BY J. Richards DATE 10/81

CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-220	Reboilers	2 each	$21,203	$ 42,406	5,600	11,200	
	Typical BEU Exchanger						
	Use Page A-3 600# Rating, 400 ft^2						
	TOTAL REBOILERS			42,406		11,200	
	Installation Labor	48 mh	$30	1,440			
100-341	Pump Surge Tank	2 each	4,356	8,712	1,334	2,668	
	2" diameter x 4' T to T, 316 SS						
	same as page A-2						
	TOTAL TANKS			8,712		2,668	
	Installation Labor	80 mh	30	2,400			
100-286	Pumps - 5 gpm up to 70 ft hd,	4 each	1,705	6,820	400	1,600	
	316 SS Internal, in-line, centr.						
100-652	Motors, 1-1/2 HP	4 each	296	1,184			
	TOTAL PUMPS			8,004		1,600	
	Installation Labor	4 x 22 mh	30	2,640			

ESTIMATE WORK SHEET

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE
100-0 Equipment
Chemical By-Product Processing - Methanol Storage Tank

ESTIMATE NO
SHEET NO. D-5 of 5
PREPARED BY J. Richards DATE 10/8
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-341	Methanol Storage Tank						
	72" diameter x 12' T to T	1 each					
	316 SS shell 5/8" thick material	12'	$ 684	$ 8,208	485	5,820	
	2 each S.E. Heads	Pair	7,695	7,695	2,646	2,646	
	Nozzles 6" 150# RF	2 each	831	1,662	60	120	
	4" 150# RF	1 each	657	657	33	33	
	18" man way	1 each	3,174	3,174	358	358	
	Wear Plates	Pair	391	391	128	128	
	Saddles	Pair	1,163	1,163	650	650	
	TOTAL METHANE STORAGE TANK			22,950		9,755	
	Installation Labor (18 + (1.5 x 5))	26 mh	30	780			
100-341	Furfural Storage Tank						
	72" diameter x 18' T to T						∿ 305,000
	316 SS shell 5/8" thick material	18'	684	12,312	485	8,730	
	2 each SE heads	Pair	7,695	7,695	2,646	2,646	
	Nozzles 6" 150# RF	2 each	831	1,662	60	120	
	4" 150# RF	1 each	657	657	33	33	
	18" man way	1 each	3,174	3,174	358	358	
	Wear Plates	Pair	391	391	128	128	
	Saddles	Pair	1,163	1,163	650	650	
	TOTAL FURFURAL STORAGE TANK			27,054		12,665	
	Installation Labor (18 + (1.5 x 7))	30	30	900			
	TOTAL STORAGE TANKS			50,004			
	TOTAL LABOR			1,680			

QUANTITY SURVEY

MULTITECH

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE SECTION E
ACCOUNT 100-0 Equipment
Neutralization

ESTIMATE NO
SHEET NO E-1 of 5
PREPARED BY J. Richards DATE 10/81
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	DIA.	T to T	PRESS.	TEMP.	MATL.	MATL. THICK.	CAPA.	MATL. RATING.
	Concentrated Sugar Solution Tank	1 ea.	12'	48'			316 SS	5/8"	40,000 gal	
	Dilute Sugar Solution Tank	1 ea.	12'	12'			316 SS	5/8"	10,000 gal	
	Sugar Solution Storage Tank	1 ea.	12'	48'			316 SS	5/8"	40,000 gal	
	Pumps		FLOW	HEAD	PRESS.	MATL	TYPE	DRIVE		
	Digester Transfer	1 ea.	50 gpm	102 ft		316 SS		5.0 HP		
	Neutralizer Transfer	1 ea.	200 gpm	30 ft		316 SS		7.5 HP		
	Sugar Solution Transfer	1 ea.	25 gpm	30 ft		316 SS		2.0 HP		
	Centrifuge Transfer	1 ea.	10 gpm	30 ft		316 SS		2.0 HP		
	Sludge	1 ea.	200 gpm	30 ft		316 SS		7.5 HP		
	Fermentation Transfer	1 ea.	200 gpm	30 ft		316 SS		7.5 HP		
	Cascade & Sand Filter	1 ea.								
	Centrifugal Separator									
	Lime Storage Bin	1 ea.							50 Tons	
	Mixers, In-Line	4 ea.								
	Tubular Conveyor with Bag Breaker	1 ea.		40'	Model 200					
	Hopper			30" sq. x 36" hi						

MULTITECH

ESTIMATE WORK SHEET

PROJECT: FUEL ETHANOL PRODUCTION FROM WOOD WASTE
100-0 Equipment
Neutralization - Concentrated Solution and Sugar Solution Storage Tanks

ESTIMATE NO
SHEET NO. E-2 of 5
PREPARED BY J. Richards DATE 10/81
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-341	Concentrated Sugar Solution	1 ea.					3 x C.S. Prices, 316 SS
	Shell 144" diameter x 48' (spot x-ray) 5/8" 316 SS	48'	$ 1,122	$ 53,856	965.7	46,354	
	2 Semi-Eliptical Heads	2 pr.	8,850	8,850		11,065	
	Support Legs	2 ea.	92	736	100	800	
	Nozzles						
	6" RF 150#	6 ea.	837	4,986	60	360	
	18" Manway	1 ea.	3,174	3,174	358	358	
	Platforms Not Required						
	Total Concentrated Sugar Solution Tank	1 ea.		71,602		58,938	Use $30/hr for composite crew and crane time
	Installation	80 MH	$30/hr	2,400			
100-341	Sugar Solution Storage Tank (equal to concentrated sugar solution tank)	1 ea.	71,602			58,928	
	Installation - Labor	80 MH	$30/hr	2,400			

ESTIMATE WORK SHEET

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE
100-0 Equipment
Neutralization - Dilute Solution Storage Tank

ESTIMATE NO
SHEET NO. E-3 of 5
PREPARED BY J. Richards DATE 10/81
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-341	Dilute Sugar Solution Storage Tank	1 ea.					
	316 SS 5/8" thick material						
	spot X-rayed						
	Shell, 144" diameter (spot X-rayed)	12'	$ 1,127	$ 13,462	965.7	11,589	
	2 S.E. heads (spot X-rayed)	pair	8,850	8,850	11,056	11,056	
	Support Legs	8 ea.	92	736	100	800	
	Nozzles						
	6" R.F. 150#	6 ea.	831	4,986	60	360	
	18" Manway	1 ea.	3,174	3,174	358	358	
	Total Dilute Sugar Solution Storage Tank	1 ea.		31,208		24,163	
	Installation - Labor (1.8 x 13) + 24	48 MH	$30/hr	1,440			

ESTIMATE WORK SHEET

PROJECT: FUEL ETHANOL PRODUCTION FROM WOOD WASTE
100-0 Equipment
Neutralization - Pumps

ESTIMATE NO
SHEET NO. E-4 of 5
PREPARED BY J. Richards DATE 10/81
CHECKED BY: DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-282	Digester Transfer Pump Single Stage, Centrifugal 50 gpm	1 ea.	$ 2,900	$ 2,900	365	365	
100-652	5 HP Nema, TEFC	1 ea.	350	350			
100-282	Transfer Pump (25 or 10 gpm)	2 ea.	2,700	5,400	180	360	
100-652	2 HP Nema, TEFC Motor	2 ea.	255	510			
100-282	Neutralizer Transfer, Sludge, and Fermitting Transfer Pump - 200 gpm	3 ea.	4,000	12,000	450	1,350	
100-652	7.5 HP Motor	3 ea.	426	1,278			
	Total Pumps	6 ea.		22,438		2,100	
	Installation - Labor	144 MH	$30/hr	4,320			

ESTIMATE WORK SHEET

MULTITECH

PROJECT: FUEL ETHANOL PRODUCTION FROM WOOD WASTE
100-0 Equipment
Neutrlization - Centrifugal Separator Mixers

ESTIMATE NO
SHEET NO. E-5 of 5
PREPARED BY J. Richards DATE 10/8
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-0	Centrifugal Separator	1 ea.	$90,000	$ 90,000		3,000	
	Installation	80 MH	$30/hr	2,400			
100-0	Cascade and Sand Filter	1 ea.	130,000	130,000		28,200	
	Installation	240 MH	$30/hr	7,200			
100-0	Lime Storage Bin	1 ea.					
	Material	1,469 lb	.53	779		1,469	
	Weld	288 in.	.54	156			
		1,469 lb.	.20	294			
	Bin Total			779			
	Installation			450			
100-0	Mixers, In-Line	2 ea.	1,500	3,000	300	600	
	Installation	80 MH	$30/hr	2,400			
100-0	Tubular Conveyor with Bag Breaker Hopper C.S.	1 ea.	2,700	2,700		2,000	
	Installation	40 MH	$30/hr	1,200			
	Total Installation						

MULTITECH

QUANTITY SURVEY

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE SECTION F
ACCOUNT 100-0 Equipment
Fermentation

ESTIMATE NO
SHEET NO F-1 of 6
PREPARED BY MAHB DATE 10/
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	DIA.	RPM/HP	PRESS.	TEMP.	MATL.	MATL. THICK.	AREA CAPA.	
100-341	Yeast Mix Tank	1	6'x5'						1,000 ga	
100-145	Yeast Mix Agitator	1		1150/1.5						
100-282	Yeast Transfer Pump			5 HP					50 gpm	
100-145	Fermenter Tank Agitator	6		68/75						
100-341	Sterilization Tank	1	6'x5'						1,000 ga	
100-145	Sterilization Tank Mixer	1		1150/1.5						
100-341	Cleaning Chemical Tank	1	6'x5'						1,000 ga	
100-145	Cleaning Chemical Tank Agitator			1150/1.5						
100-341	Yeast Wash Tank		6'x5'						1,000 ga	
100-145	Yeast Wash Agitator			1150/1.5						
100-0	Yeast Wash Separator	1		50 HP						
100-220	Sugar Solution Cooler	1					C.S./SS			
100-341	Fermentation Tanks	6	12'x45'				C.S.		48,400	
100-341	Beer Storage Tanks	2	12'x45'				C.S.		40,000	
100-282	Transfer Pump Without Drive	1					316		200	
100-0	Yeast Clean Centrifuge	2					316		400 gpm	
100-651	Yeast Drive	2		50 HP						
100-282	Transfer Pump	8					316		500 gpm	
100-651	Drive	8		50 HP						

ESTIMATE WORK SHEET

PROJECT: FUEL ETHANOL PRODUCTION FROM WOOD WASTE

100-0 Equipment
Fermentation - Pumps

ESTIMATE NO
SHEET NO. F-2 of 6
PREPARED BY MAHB DATE 10/81
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-282	Yeast Transfer Pump 5 gpm	1 ea.	$ 870	$ 870	135	135	3 HP Drive
100-282	Transfer Pump 200 gpm	1 ea.	4,000	4,000	450	450	7.5 HP Drive
100-282	Transfer Pump 500 gpm	6 ea.	1,706	10,236	455	2,730	50 HP Drive
	Total for Pumps	8 ea.		15,106		3,315	
100-651	Drivers						
	3 HP NEMA "A" TEFC	1 ea.		250			
	7.5 HP NEMA "A" TEFC	1		420			
	50 HP NEMA "A" TEFC	6	1,940	11,650			
	Total for Drive			12,310			
	Total Pumps			27,416			
	Installation						
	2 (24) 48						
	6 (32) 192	240	$30/hr	7,200			

MULTITECH

ESTIMATE WORK SHEET

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE
100-0 Equipment
Fermentation - Fermenation, Beer Storage Tanks

ESTIMATE NO
SHEET NO. F-3 of 6
PREPARED BY J. Richards DATE 10/81
CHECKED BY: DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-341	Fermentation and Beer Storage Tanks	8 ea.					
	12' diameter x 45' T to T						
	Carbon Steel Construction						
	144" diameter shell x 45'	45'	$ 420	$ 18,900	966	43,470	
	5/8" thick material						
	S.E. Heads	pair	4,925	4,925	11,056	11,056	
	Nozzles						
	6" RF 150 #	6 ea.	277	1,662	60	360	
	18" Manway	1 ea.	1,058	1,058	358	358	
	Support Legs	8 ea.	92	736	100	800	
	Total One Tank			27,281		56,044	Use 30 tons
	Installation (1.8 x 15) + 51 = 78	80 MH	$30/hr	2,400			
	Total for Fermentation and Beer Storage Tanks	8 ea.	27,281	218,248	56,044	448,352	
	Installation	8 x 80	$30/hr	19,200			

MULTITECH

ESTIMATE WORK SHEET

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE
100-0 Equipment
Fermentation Section - Yeast, Sterilization, Yeast Wash, and
Cleaning Chemical Tanks

ESTIMATE NO
SHEET NO. F-4 of 6
PREPARED BY J. Richards DATE 10/81
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-341	Tanks, S-S 72" x 5' T to T	4 ea.					
	5/8" thick shell	5'	$ 729	$ 3,645	445	2,225	
	S.E. Heads	pair	7,965	7,965	1,119	1,119	
	Nozzles 6" RF 150#	3 ea.	831	2,493	60	180	
	Support Legs	4 ea.	92	368	100	400	
	Total One Tank	1 ea.		14,471		3,924	Use two tons
	Installation	40 MH	$30/hr	1,200			
	Total Yeast, Sterilization and Cleaning Tanks	4 ea.	14,471	57,884	3,924	15,696	
	Installation 40 x 4	160 MH	$30/hr	4,800			

MULTITECH

ESTIMATE WORK SHEET

PROJECT: FUEL ETHANOL PRODUCTION FROM WOOD WASTE

100-0 Equipment
Fermentation - Agitators, Cooler

ESTIMATE NO
SHEET NO. F-5 of 6
PREPARED BY MAHB DATE 10/81
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-145	Agitators for all Tanks						
	Bath Homogenizer Mixer Model #6H with Drive	12	$ 5,600	$ 67,200	900	10,800	
	Total						
	Installation (12 x 32)	384	$30/hr	11,520			
100-220	Sugar Solution Cooler	1	22,613	22,613	1,850	1,850	
	Modify With 316 SS Tubes		4,000	4,000			
	Total for Cooler			26,613		1,850	
	Installation	20 MH	$30/hr	600			

MULTITECH

ESTIMATE WORK SHEET

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE

100-Equipment
Fermentation - Centrifuges

ESTIMATE NO
SHEET NO. F-6 of 6
PREPARED BY MAHB DATE 10/81
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-0	Yeast Cream Centrifuge Separator	2 ea.	$90,000	$180,000	3,000	6,000	$ 10,000 each for P&C
	Yeast Wash Separator	1 ea.	90,000	90,000		3,000	
	Total Centrifuges and Separator			$270,000		9,000	
	Installation - Labor	3 x 240	$30/hr	21,600			

MULTITECH

QUANTITY SURVEY

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE SECTION G
ACCOUNT 100-0 Equipment
Distillation Section

ESTIMATE NO
SHEET NO G-1 of 2
PREPARED BY J. Richards DATE 10/81
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	DIA.	T to T	WIDTH	HEIGHT	LENGTH	SPACE	CAP.	TOTAL
100-0	Distillation Section									
	Beer Stripper/Rectifier		42"	75'						
	Anhydrous Tower and Reboiler		36"	80'						
	Hydrocarbon Stripper		24"	45'						
	Reflux Drum									
	Fusel Oil Batch Decanter									
	Tank									
	All Piping Instrumentation									
	Pumps									
	Exchangers									
	Total Size on Skids	2 ea.			12'	12'	30'	15'		40'-30'
100-341	Ethanol Storage Tanks, C.S.	2 ea.	144"	60'					50,000 gal	
100-286	Pump 200 gpm, 316 SS	1 ea.								

ESTIMATE WORK SHEET

MULTITECH

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE
100-0 Equipment
Distillation Section

ESTIMATE NO
SHEET NO. G-2 of 2
PREPARED BY J. Richards DATE 10/81
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-0	Distillation Section	1 ea.	$545,000	$545,000	70,000	70,000	
	Installation - Labor	1,000 MH	$30/hr	30,000			
100-341	Ethanol Storage Tanks 50,000 gal. C.S. 5/8" thick	2 ea.					
	Shell, Spot X-Ray, C.S. 5/8" thick	60'	374	$ 22,440	965.7	57,942	
	2 ea. S.E. Heads	Pair	8,951	8,951	11,056	11,056	
	Legs and Base Plates	4 ea.	92	368	100	400	
	Nozzles						
	2" 150# RF	4 ea	91	364	14	56	
	6" 150# RF	2 ea.	277	554	60	120	
	18" 150# RF	1 ea.	1,058	1,058	358	358	
	Blind Flange 18"	1 ea	649	649	310	310	
	Total One Tank	1 ea.		34,384		70,242	
	Installation - Labor (59 + (0.8 x 6))	65 MH	$30/hr	1,950			
	Total Tanks	2 ea.	34,384	68,768	70,242	140,484	
100-282	Ethanol Transfer Pump	1 ea.	4,000	4,000	450	450	
100-652	7-1/2 HP, TEFC, Explosion-Proof, NEMA B, Class B Insulation	1 ea.	748	748	250	250	
	Total Transfer Pump			4,748	700		
	Installation - Labor	24 MH	$30/hr	720			

QUANTITY SURVEY

MULTITECH

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE SECTION H
ACCOUNT
100-0 Equipment
Sugar By-Product Recovery

ESTIMATE NO
SHEET NO H-1 of 6
PREPARED BY MAHB DATE 10/8
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	DIA.	T to T	PRESSURE	TEMP.	MATL.	MATL. THICKNESS	CAP. AREA	
100-0	First Stage Evaporator	1			50 psia	225°F	316		1,500	
100-0	Second Stage Evaporator	1			50 psia	250°F	316			
100-220	Stillage Preheater	1			50 psia	250°F	316		50 ft^2	
100-220	Preheater	1			50 psia	250°F	316		50 ft^2	
100-220	Molasses Preheater	1			50 psia	250°F	316		50 ft^2	
100-230	Condenser	1			50 psia	250°F	316		50 ft^2	
100-341	First Stage Flash Drum	1	2'	4'	50 psia	250°F	316			
100-341	Second Stage Flash Drum	1	2'	4'	50 psia	250°F	316			
100-341	Thin Stillage Tank	1	12'	24'			316		2,000 gal	
100-341	Molasses Storage Tank	1	12'	60'			316		50,000 gal	
100-282	Pumps									
	Transfer Pump	1					316		200 gpm	45' TDH
	Circulation Pump	1					316		1,000 gpm	100' TD
	Circulation Pump	1					316		100 gpm	100' TD
	First Stage Circulation Pump	1					316		50 gpm	100' TD
	Second Stage Circulation Pump	1					316		50 gpm	45' TD
	Transfer Pump	1					316		25 gpm	25' TD
100-0	Steam Compressor	1			7 psi				88,500 lb/hr	

ESTIMATE WORK SHEET

MULTITECH

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE

100-0 Equipment

Sugar By-Product Recovery - Pumps

ESTIMATE NO

SHEET NO. H-2 of 6

PREPARED BY MAHB DATE 10/81

CHECKED BY: DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-282	Transfer Pump (200 gpm)	1	$ 4,000	$ 4,000	450	450	7-1/2 HP
100-282	Circulation Pump (1,000 gpm)	1	6,250	6,250	615	615	50 HP
100-282	Circulation Pump (100 gpm)	1	3,700	3,700	440	440	5 HP
100-282	First Stage Circulation Pump (50 gpm)	1	2,900	2,900	365	365	5 HP
100-282	Second Stage Circulation Pump (50 gpm)	1	2,700	2,700	180	180	2 HP
100-282	Transfer Pump (25 gpm)	1	2,700	2,700	180	180	2 HP
	Drivers						
	50 HP NEMA Design A TEFC	1	2,000	2,000	--	--	
	7-1/2 HP NEMA Design A TEFC	1	426	426	--	--	
	5 HP NEMA Design A TEFC	2	350	700	--	--	
	2 HP NEMA Design A TEFC	2	255	510	--	--	
	TOTAL PUMPS			$25,886		2,230	
	Installation (5 x 24) + 1 x 32	152	30	$ 4,560	--	--	

MULTITECH

ESTIMATE WORK SHEET

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE
100-0 Equipment
Sugar By-Product Recovery
Evaporator Section and Final Condensor

ESTIMATE NO
SHEET NO. H-3 of 6
PREPARED BY MAHB DATE 10/81
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-0	First Stage Evaporator						
	Second Stage Evaporator						
	Vapor Condensor and Steam Compressor						
	(Vendor Quote)			$246,041	42,000	42,000	
	Installation	160	$ 30	4,800			
100-230	Condenser	1	$12,300	12,300		1,850	
	Model 85-E STOKES, Inc.						
	Vertical Tube Surface						
	Condenser or receiver						
	Vacuum Type						
	Modify using 315 SS tubes			4,000			
	Total Final Condenser			16,300		1,850	
	Installation	18 MH	30	540			

MULTITECH

ESTIMATE WORK SHEET

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE

100-0 Equipment
Sugar By-Product Recovery - Flash Drum

ESTIMATE NO
SHEET NO. H-4 of 6
PREPARED BY MAHB DATE 10/8
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-341	Flash Drums 316 SS	2	$ 4,356	$ 8,712	1,334	2,668	
	From page A-2						
	Installation 40 x 2	80	30	2,400			

MULTITECH

ESTIMATE WORK SHEET

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE
100-0 Equipment
Sugar By-Product Recovery - Tanks

ESTIMATE NO
SHEET NO. H-5 of 6
PREPARED BY MAHB DATE 10/81
CHECKED BY: DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-341	Thin Stillage Tank 316 SS	1					
	12' x 24" 5/8 Tank	24 ft	$ 1,260	$ 30,240	965.70	23,177	
	2 S.E. Head	pair	14,775	14,775	11,056	11,056	
	All Other	AR		7,000		1,767	
	Total Thin Stillage Tank			52,015		36,000	18 tons
	Labor	30	30	900			
100-341	Concentrated Solution Tank						
	12' x 60' 5/8 thick 316 SS	60 ft	1,260	75,600	965.70	57,942	
	SE Heads	2	14,775	14,775	11,056	11,056	
	All Others	AR		7,000		1,767	
	Total Concentrated Sulution Tank			97,375		70,765	36 tons
	Labor	88	30	2,640			
	Total for Tanks			149,390		106,765	
	Installation	118 MH	30	3,540			

ESTIMATE WORK SHEET

PROJECT: FUEL ETHANOL PRODUCTION FROM WOOD WASTE

100-0 Equipment
Sugar By-Product Recovery - Preheater

ESTIMATE NO
SHEET NO. H-6 of 6
PREPARED BY MAHB DATE 10/8
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
	From Digester Water Heater						
100-200	Preheater Modify using 316 SS tubes	3	$21,205	$63,615	5,600	16,000	
	Total Preheaters	3		63,615			
	Installation (24 x 3)	72	30	2,160			
	Steam Compressor						Included in Evaporator Cost

ESTIMATE WORK SHEET

MULTITECH

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE SECTION I
General Costs

ESTIMATE NO
SHEET NO. I-1 of 7
PREPARED BY J. Richards DATE 10/81
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
1-0	Hydrolyzer/Neutralizer Building 6,000 sq. ft., use mid, structural steel frame	6,000	$ 44	$264,000	--	--	All costs in this sectio include labor
	Boiler Building 3,920 sq. ft., us mid, reinforced concrete	3,920	40	156,800	--	--	
	Fermentation and Distillation Bldg. 5,200 sq. ft., use high, structural steel frame	5,200	54	280,800			
	Administration & Maintenance Bldg. 1,600 sq. ft., use mid, masonry construction	1,600	32.5	52,000			
	Total			753,600			
2-0	Site Work						
2-14	Excavation and Backfill Class 1 Matl						
	Wood Storage 200 x 200 x 1	40,000 cft					
	Settling Ponds 100 x 100 x 10 x 2	200,000					
	Bldg. Footings 6' x 2' x 1072	12,862					
	Coal Storage 100 x 100 x 1	10,000					
	Bldg. Pads 16,720 x 1	16,720					
	Plus Add	20,000					
	339,582 cft						
	12,600 cy	12,600 cy	3.52	44,352			
1-0	Land @ Butte Industrial Park	11.5 acres	9,000	103,500			

MULTITECH

ESTIMATE WORK SHEET

PROJECT: FUEL ETHANOL PRODUCTION FROM WOOD WASTE
General Costs

ESTIMATE NO
SHEET NO. I-2 of 7
PREPARED BY J. Richards DATE 10/81
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
3-0	Concrete						
3-5 pg. 25	Wood Storage 200' x 200' x 8"	988 cy	$166.50	$164,502			
	Wood Process 200' x 200' x 8"	988 cy	166.50	164,502			
	Coal Storage 100' x 100' x 8"	247 cy	166.50	41,126			
	Various Pads 10' x 20' x 10' x 8"	50 cy	166.50	8,325			
	Total			378,455			
2-40	Water Distribution Ductile Iron Pressure Pipe						
	6" pipe	500'	8.79	4,395			
	4" pipe	100'	6.87	687			
	6" fittings	25 ea.	300.00	7,500			
	4" fittings	5 ea.	200.00	1,000			
	6" valves	5 ea.	500.00	2,500			
	4" valves	5 ea.	400.00	2,000			
	Reduced pressure backflow for 4" @ boiler	1 ea.	2,744	2,744			
	Total			20,826			
2-43	Asphalt Concrete 4" asphalt concrete 6" cement treated base	8,000 ft²	2.19	17,520			
	Total			17,520			

ESTIMATE WORK SHEET

MULTITECH

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE
General Costs

ESTIMATE NO
SHEET NO. I-3 of 7
PREPARED BY J. Richards DATE 10/81
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
15-37	Sewage and Drainage						
	Site Drainage 6" PVC	1,000'	2.30	$ 2,300			
	Tees	6 ea.	57.24	343			
	Sewage Disposal 6"						
	Cast Iron Drain	1,400'	7.53	10,542			
	200' to settling pond from process						
	400' to sewer main						
	800' from clearing to settling pond						
	Fittings	50	60.	3,000			
	Total			16,185			
15-47	Process Piping						
	6" pipe 304 L S.S.	2,000'	67.75	135,500			
	4" pipe	4,000'	37.30	149,200			
	2" or smaller	12,000'	8.93	107,160			
	Fittings						
	6" pipe 304 L Buttweld 150	200	345.	69,000			
	4' pipe Buttweld 150	400	188	75,200			
	2" or smaller socket weld 3,000	1,200	200	144,000			
	Valves						
	6" pipe 150# flanged	20	2,237	44,740			
	4" pipe 150# flanged	40	1,264	50,560			
	2" or smaller socket weld	120	328	39,360			
	Total			814,720			

ESTIMATE WORK SHEET

MULTITECH

PROJECT FUEL ETHANOL PRODUCTION FROM WOOD WASTE
General Costs

ESTIMATE NO
SHEET NO. I-4 of 7
PREPARED BY J. Richards DATE 10/81
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
15-50	Instrumentation and Control						
	6" control valves	5	$ 3,356	$ 16,780			
	4" control valves	10	2,047	20,470			
	2" control valves	20	1,090	21,800			
	Liquid level gages	20	388	7,760			
	Pressure gages	20	100	2,000			
	Thermowells	20	175	3,500			
	Flow transmitters	5	1,100	5,500			
	Pressure transmitters	10	1,000	10,000			
	Temperature transmitters	10	1,000	10,000			
	Level transmitters	5	1,500	7,500			
	Control Panels	5	3,713	18,565			
	7'-6" high x 4'	4 ft	310	1,240			
	Annunciator adapter	1	520	520			
	Alarm Horn	1	50	50			
	Alarms	6	110	660			
	Annunciators	1	443	443			
	Labor	40	20	800			
	Instrument Piping (Control Valves)	35	365	12,775			
	(Instruments)	10	600	6,000			
	(Tubing)	45	89.60	4,032			
	(Level gage installation)	20	204	4,080			
	Total			150,762			
15-76	Hangers and Supports						
	Brackets	100	2,436	2,436			
	Pipe anchor	100	1,799	1,799			
	Clevis hangers	100	443	443			
	Installation - Labor						
	(75 + 16 + 75)	166	18	2,988			
	Total			7,666			

MULTITECH

ESTIMATE WORK SHEET

PROJECT: FUEL ETHANOL PRODUCTION FROM WOOD WASTE
General Costs

ESTIMATE NO
SHEET NO. I-5 of 6
PREPARED BY J. Richards DATE 10/81
CHECKED BY: DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
16-0	Power Distribution						
	Underground fiber conduit systems	150	$ 667	$ 1,000			
	15,000 V armored cable	150	28.67	4,300			
	Service entrance 4,000 amp 4 wire	2 sections	3,713	7,426			
		40	18	720			
	Circuit breakers 800	5	5,189	27,445			
	Main circuit breaker panels	5	3,230	16,150			
	800 amps - 3 PH 4 wire						
	PVC conduit 3"	1,200'	9.90	11,880			
	600 V amored cable	1,200	5.60	6,720			
	3/4" conduit	8,000'	.80	6,400			
	8/3 standard stranded	8,000'	2.29	18,320			
	Motor control centers						
	10-15 HP SS nonreversing	6	5,000	30,000			
	Total			130,361			
16-24	Instrumentation Wiring 24 pair	8,000	2.43	19,440			
	Conduit 3/4"	8,000	.80	6,400			
	Total			25,840			

ESTIMATE WORK SHEET

MULTITECH

PROJECT: FUEL ETHANOL PRODUCTION FROM WOOD WASTE
General Costs

ESTIMATE NO
SHEET NO. I-6 of 7
PREPARED BY J. Richards DATE 10/81
CHECKED BY DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
2-60	Settling Ponds (subcontract price)	1,000'	$ 25.56	$ 25,560			
1-0	Caterpiller 966-D Wheel loaders 4-yard bucket	3 ea.	167,000	501,000			
5-0	Miscellaneous Structural Steel 25 tons - 50,000 lb	50,000 lb	.53	26,500			
	Weld	24,000"	.52	12,480			
	Installation	50,000	.20	10,000			
	Total			48,980			

ESTIMATE WORK SHEET

MULTITECH

PROJECT: FUEL ETHANOL PRODUCTION FROM WOOD WASTE
General Costs

ESTIMATE NO:
SHEET NO. I-7 of 7
PREPARED BY J. Richards DATE 10/81
CHECKED BY: DATE

ACCOUNT	DESCRIPTION	QUANTITY	COSTS		WEIGHT		REMARKS
			UNIT PRICE	AMOUNT	UNIT WT.	TOTAL	
100-0	Boiler T600P CNB Tri-Fuel	5 ea.	$240,000	$1,200,000	46,000	230,000	
	20,000 #/hr, 150 psi						
	complete with stoker						
	Installation - Labor	400 MH	$30/hr	12,000			
5-10	Railroad Unloading Hopper						
	Material	2,983"	.46	1,352		2,938	
	Welding	288"	.86	248			
	Installation	2,938	.20	588			
	Total Hopper	1 ea.		1,352		2,938	
	Installation			836			
100-7	Conveyors - 30'	2 ea.	12,859	25,718	6,972	13,944	
	Installation - Labor	2 ea.	3,540	7,080			
5-10	Stoker Feed Bin						
	Material	12,240#	.46	5,631		12,240	
	Welding	1,152"	.86	995			
	Installation	12,240#	.20	2,443			
	Total Bin	1 ea.		5,631		12,240	
	Installation - Labor			3,443			
	Boiler Total			1,232,701			
	Installation - Total			23,359			

DNRC 451-811,
AMENDMENT NO. 6

FUEL GRADE ETHANOL PRODUCTION USING WOOD WASTE (RESIDUES) AT SELECTED SITES IN MONTANA

FEASIBILITY STUDY - FINAL REPORT
VOLUME IV: PRELIMINARY ENVIRONMENTAL AND REGULATORY PLANNING

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JUNE 1985

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1.0 INTRODUCTION

The study discussed in this report was funded by a follow-on grant received from the Montana Department of Natural Resources and Conservation (DNRC) to MultiTech of Butte, Montana (Montana DNRC, 1982). The Energy Division of the Department was the immediate technical and contract monitor.

In Part I of the study, MultiTech conducted detailed technical and economic feasibility studies for a 2.5-million gallon per year (Mgpy) Fuel Grade Ethanol (FGE) facility, to be located in the vicinity of Anaconda, Montana. The results of the study indicated that utilization of a modified Madison residue-to-ethanol conversion process was technically feasible. However, the estimated quantity of residue feedstock did not appear sufficient to support an operation of the above scale (MultiTech, 1982). Thus, the original grant agreement was amended to allow: 1) a recommendation of lesser-sized FGE production capacities at Anaconda; and 2) an evaluation of the technical and economic feasibility of FGE production at various scales of operation within the Lincoln and Livingston, Montana, areas.

2.0 BACKGROUND INFORMATION UTILIZED

2.1 FACILITY TYPE

A modified Madison Wood Process is proposed for converting lignocellulosic agricultural, municipal, and forestry residues to FGE. The shredded or pulverized feedstock is treated initially with steam generated by a coal-fired plant; the resulting "wood lint" is then hydrolyzed using dilute sulfuric acid. Glucose (and other six-carbon sugars) are fermented using Saccharomyces cerevisiae yeast strain. Unless economic incentives dictate otherwise, the CO_2 produced during fermentation will be vented to the atmosphere. Two-stage steam distillation of the "beer" will produce anhydrous ethanol. Associated by-products recovered include anhydrous methanol, furfural, and crude molasses. In compliance with Bureau of Alcohol, Tobacco and Firearms (BATF) regulations, the ethanol will be denatured using non-leaded gasoline prior to being stored on-site.

2.2 PROCESS OVERVIEW

This section presents a brief summary of materials required or generated by a 2.5 Mgpy FGE facility. This plant capacity is the largest considered in this study and is most desirable economically for the scales considered (MultiTech, 1984b). Plant inputs and outputs are summarized in Table 2-1, while process flow and material balance are presented in Figure 2-1. A tentative plot plan is given in Figure 2-2. Further technical details can be found in Section 2.0 of the Milestone No. 3 report (MultiTech, 1984a).

TABLE 2-1.--APPROXIMATE INPUTS AND OUTPUTS FOR A 2.5 MGPY FGE FACILITY[a]

PART A. INPUTS

Feedstock	Quantity
Lignocellulosic ("Woody") wastes	58,508 oven-dry tons-per-yr.[b]
Sulfuric acid	2,772 tpy
Lime hydrate	4,574 tpy
Electricity	17,994,000 kWh per year
Coal	20,955 tpy
Water	165,000,000 gpy
Unleaded gasoline	25,000,500 gpy

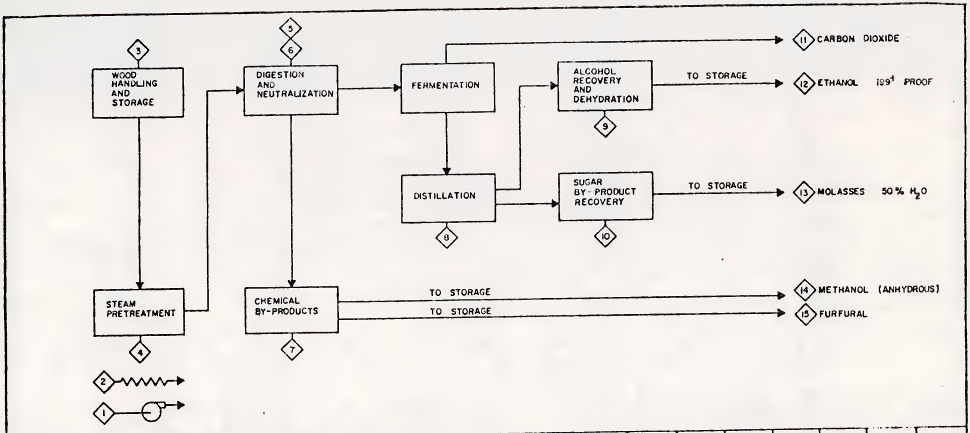
PART B. OUTPUTS

Product	Quantity
Anhydrous ethanol	2,500,000 gpy
Anhydrous methanol	120,000 gpy
Technical-grade furfural	990,000 lbs.-per-year
Syrup (Crude molasses)	3,960 tpy
Carbon dioxide	8,125 tpy

Notes: a) Facility operations are presumed to be 24 hrs./day, 7 days/week, 340 days/yr. Routine maintenance is continuous while annual maintenance is assumed to require one week. An additional week/yr. is allocated to boiler inspection and repair.

b) Equivalent to 100,650 green tpy.

Source: MultiTech, 1984b.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
FURFURAL LBS/DAY															3000		
METHANOL GAL/DAY														364			
MOLASSES LBS/DAY													24,000				
ETHANOL GAL/DAY												7,600					
CARBON DIOXIDE LBS/DAY											49,100						
STEAM LBS/DAY				380,000			35,000	167,200	76,000	96,000							
HYDRATED LIME LBS/DAY						9530											
SULFURIC ACID LBS/DAY					16,800												
WOOD INTAKE ODT/DAY			155														
ELECTRICAL KWH/DAY		54,528															
WATER MILL. GAL/DAY	0.5																
STM.RCV & RECYCLE LBS/DAY				(323,000)			(31,500)	(150,400)	(68,400)	(86,400)							

FLOW DIAGRAM AND MATERIAL BALANCE

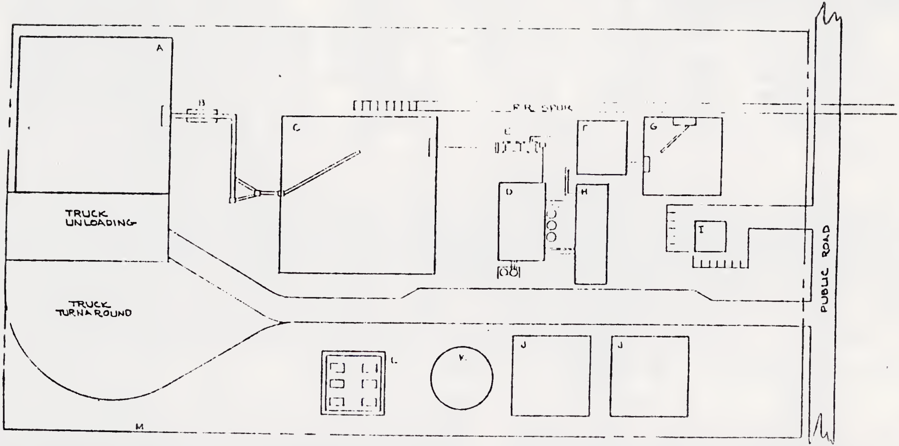
Fuel Ethanol Production From Wood Waste

SCALE: NONE
DATE 11/81
APPROVED BY JHW
DRAWN BY MAS
REVISED

2.5 MILLION GPY PLANT

MULTITECH INC BUTTE MT
DRAWING NUMBER 24-000-110-B

FIGURE 2-1.--2.5 MILLION GPY PLANT FLOW DIAGRAM AND MATERIAL BALANCE.



	SCHEDULE	SIZE
A	WOOD WASTE STORAGE	200' X 200'
B	CLEANING POND	20' X 40'
C	PROCESS WOOD STORAGE	200' X 200'
D	HYDROL & NEU BLDG	100' X 60'
E	STEAM PRETREATMENT	30' X 40'
F	BOILER BLDG	56' X 70'
G	COAL STORAGE	100' X 100'
H	FERMENTATION & DISTILLATION	40' X 130'
I	ADMIN BUILDING	40' X 40'

	SCHEDULE	SIZE
J	SETTLING PONDS (2)	100' X 100' EACH
K	CLARIFIER	80' DIA.
L	TANK FARM	80' X 80'
M	LAND DIMENSIONS	1000' X 500' (11.5 Ac.)

Fuel Ethanol Production From Wood Waste

SCALE: NONE	APPROVED BY	DRAWN BY MAS
DATE 11/81	JHW	REVISED

TYPICAL SITE PLAN

MULTITECH INC BUTTE MT

DRAWING NUMBER 24 000-100-B

FIGURE 2-2.--TYPICAL SITE PLAN

2.2.1 Feedstock and Other Raw Material Requirements

Conservative estimates of annual feedstock availability for the Anaconda, Lincoln, and Livingston sites are shown in Table 2-2. The effects of moderate swings in the cyclic economies of food and fiber production, plus environmental constraints on residue harvesting, have been factored into these estimates. The price assumed for cost and haulage distance estimates, as delivered to the plant gate, is about $25 per screen ton. This price is competitive with that paid currently by other users of the resource. Table 2-2 data indicate that at least Lincoln and Livingston feedstock resources can support a 2.5 Mgpy plant; the Anaconda site could only reach that level if a larger (>25 mile) logging residue haul distance can be justified. The lignocellulosic wastes are delivered to the plant site using large capacity semi-trailers with drop-sides and/or by railroad hopper car. It is likely that five-to-ten truckloads of "woody" waste will be delivered daily to the storage area.

One to two loads each of sulfuric acid, hydrated lime, and unleaded gasoline will be delivered by truck to the site on a weekly basis. The steam plant will consume approximately 4.5 100-ton capacity hopper cars of coal per week. The cleaned, dried, and crushed coal is transferred from the (bottom dump) collection pit to the storage silo via an auger system. A second auger or conveyor system then transfers coal to the boiler building on an as-needed basis.

Depending upon site conditions, the water supply will utilize either an existing (municipal) source or develop its own surface water or groundwater source. At least a portion of the daily water requirement will be deionized for process use (including steam generation); water designated for potable/domestic uses

TABLE 2-2.--ESTIMATED ANNUAL LIGNOCELLULOSIC FEEDSTOCK QUANTITIES AND FGE PRODUCTION CAPACITIES FOR THE THREE STUDY SITES (OVEN-DRY TPY)

FGE Plant Site	Logging Residues	Mill Residues	Wood fiber Recovery/ Recycling	Wheat Straw	Total	FGE (10^6gpy)
Anaconda	24,457	9,981	3,714	8,023	46,175	2.14
Lincoln	17,115	1,003	1,770	44,315	75,959	3.12
Livingston	7,216	1,444	1,861	55,035	65,556	3.23

Notes: a) Wood fiber-related data for Anaconda site was taken from MultiTech, 1982 (p.4-71), while similar data for Lincoln and Livingston sites were taken from MultiTech 1983a,b. All previously reported values are converted from green weight to oven-dry weight via multiplying the former figures by 0.5813. Wheat straw estimates were generated using Crane and Green (1980) and Montana Agricultural Statistics (1952-1977).

b) Assumes residue-to-FGE conversion ratios of 45.5 and 50.0 gal. FGE per dry ton of "woody" residues and wheat straw, respectively (MultiTech, 1982, 1984a).

may also need some form of treatment, depending upon [illegible] to be used for fire control and other emergency uses may not be [illegible] prior to storage. Innovative design of plant operations could [illegible] the previously stated water requirement (Table 2-1) considerably. Such [illegible] include forced draft/blower-type cooling units (which would eliminate [illegible] losses) and freon-to-air cooling systems with associated cogeneration [illegible] electricity. Although such equipment is commercially available and [illegible] be considered in subsequent design phases, more conventional designs were [illegible] a conservative estimate of economic feasibility.

2.2.2 Energy Requirements

Electric power will be supplied primarily from overhead transmission lines connected to the local power grid. The plant will interface with the grid via a 2300 Kva substation, located on-site. Step-down transformers will reduce the voltage to required levels and distribute it via underground and/or overhead lines to points of consumption.

Diesel-or propane-fired electrical generators will provide [illegible] emergency power for safe facility operations.

2.2.3 Marketable End-Products

As shown in Figure 2-2, the liquid products are pumped to the appropriate storage area. Tanker trucks will remove approximately one load of syrup and twenty loads of gasohol (1:9 FGE: gasoline) per week. The ethanol may be consumed in the denaturing process; otherwise, a tanker truck [illegible] both it and furfural will be removed from the site every 4 to 6 weeks

2.2.4 Waste Products

Preliminary estimates of daily production of gaseous emissions, liquid effluents and solid wastes are presented in Table 2-3. Given the current status of engineering design and envisioned pollution control, such estimates should be viewed as being "ballpark" only. General approaches to waste product control/handling is presented below.

2.2.4.1 Atmospheric Emissions

The use of low-sulfur coal may eliminate the need for flue gas desulfurization. Proper boiler design and operating parameters will maintain NO_x emission levels well below that limit set by EPA. Particulate (fly ash) control probably will utilize a cyclone having a mechanical collection efficiency ranging from 80 to 85 percent (Sittig, 1977).

The handling of residue feedstocks in a wetted condition (whenever possible) will minimize dusting problems. Vent condensers for scrubbing volatile organic compounds, as well as SO_2 from the digester, have been included in the preliminary engineering design (MultiTech, 1984a). Plant design and operations will comply with all appropriate safety codes and regulations regarding the accumulation of explosive and/or toxic gases, fumes, and aerosols (see Factory Mutual System, 1967).

TABLE 2-3.--PRELIMINARY ESTIMATES OF FACILITY POLLUTANT PRODUCTION, PER OPERATING DAY

PART A. ATMOSPHERIC EMISSIONS

	Quantity (lbs.)		
Source	Uncontrolled	Controlled	Comments
Coal-Fired Boiler[a,b]			
-Coal handling	--	<36	
$-SO_2$	1724	$\leq$1470	
$-NO_x$	926	$\leq$926	
-CO	125	125	
-HC	61	61	POM Fraction < 2 lbs.
-fly ash	6999	1050[c]	
Cooling Tower Drift	2632	$\leq$2632	
-Total Solids	2	<2	
$-BOD_5$	<1	<1	
-Sulfate ion	<1	<1	
Process-Related			
-Particulates			
residues receiving/ handling	710	296	
wet grinding	--	26	
$-CO_2$	48,000-59,000	$\leq$48,000	
-Total Volatile			
-Organic Compounds	122	18	
ethylene glycol	2	<1	
unleaded gasoline (storage)	21	<13	
ethanol (storage)	--	<5	
$-SO_2/NO_x$	10	1	

PART B. WASTE WATER TREATMENT DISCHARGE

Source	Controlled Quantity	Comments
Effluent from Treatment Plant		
-volume	99,000 to 156,000 gal.	
-characteristics		
BOD_5	372-1489 lbs.	Controlled from 1500 mg/L to 250 mg/L
Suspended solids	189 lbs.	Controlled from 500 mg/L to 250 mg/L

TABLE 2-3.--PRELIMINARY ESTIMATES OF FACILITY POLLUTANT PRODUCTION, PER OPERATING DAY (cont.)

PART C. SOLID WASTES

Source	Controlled Quantity (lbs.)	Comments
Coal-Fired Boiler		
-fly ash	5949	
-bottom ash	2333	
Raw Water Treatment	2206	Deionizer sludge largely
Waste Water Treatment	2234	activated sludge from
Gypsum	75,714	neutralization reaction

Notes: a) Assumes use of cleaned, dry subbituminous coal having 10,000 Btu/lb. HHV, 8.5% w/w ash content, and 0.70% w/w total sulfur content.

b) Assumes 1:3 bottom ash:fly ash ratio, for mass feed stoking of pea-sized coal.

c) Assumes use of cyclone having a control efficiency of 85 percent.

Sources: Barney et al., 1980; Dale et al., 1980; Hira et al., 1983 Watson et al., 1982.

2.2.4.2 Raw Water and Wastewater Treatment

A packaged reverse osmosis treatment system will convert incoming water to sufficient purity for process use and for worker consumption The various waste effluent streams will be collected in the settling ponds initially, then undergo necessary treatment using another packaged system. The system effluent will be suitable for discharge into an existing municipal sewage line for additional (final) treatment. Discharge rates for BOD_5 and suspended solids will be in compliance with those limits stipulated in the facility's MPDES (point source discharge) permit. The raw water and wastewater treatment sludges will be stored (at least temporarily) in the on-site evaporation pond (Figure 2-2).

2.2.4.3 Solid Wastes

The fly ash, bottom ash, and raw water/wastewater treatment sludges will be stored on-site in a bentonitic clay-lined evaporation pond. The joint storage-mixing of the "dry" coal combustion wastes with the "wet" sludges should minimize fugitive dust emissions emanating from the pond. As none of these wastes are classified under RCRA subtitle C as being hazardous, periodic removal for ultimate disposal in an approved landfill site should be considered. Otherwise, the pond will be reclaimed appropriately at the time of facility decommissioning.

It is suggested that the crude gypsum be stored in its own bentonitic clay-lined pond, as this material may possess some economic value (e.g., for wall-board manufacturing).

2.2.5 Land and Labor Requirements

2.2.5.1 Land Requirements

The proposed facility will require at least five (possibly [illegible]) acres of land. Over half of this allotment will be dedicated to the handling and storage of raw materials, products, and wastes. The steam plant and its auxiliaries, FGE production buildings, water/wastewater treatment building, scale house, administrative building and substation will require (collectively) ~1.5 acres. The remainder will be used for utility corridors, roadways, and a minimal area for site expansion/environmental impact "buffering." The site perimeter will be fenced with swing gates installed for control of vehicle and rail road traffics.

2.2.5.2 Labor Requirements

The quantity and mix of labor skills required for facility construction will be affected by process design and, to some degree, the availability of pre-assembled major components. More labor and time will be required to construct a "grass roots" plant versus one which utilizes modular components or packaged "turnkey" systems. For purposes of completing the environmental assessment, the following two assumptions were made. First, the peak construction force equals about 44 persons; the craft mix includes carpenters, electricians, plumber-pipefitters, iron workers, cement workers, bricklayers, sheet metal workers, etc. Secondly, the construction period ranges from four to six months, depending upon climatic constraints and (potential) delays in receipt of construction materials or process components.

Requirements for continuous operation of the plant will range from 16 to 21 workers. Actual manpower needed will depend upon such factors as plant layout, sophistication of facility instrumentation-control systems, and sophistication of intra-site communication systems. The likely partitioning of labor categories among the three shifts per day are shown in Table 2-4.

TABLE 2-4.--TENTATIVE PERSONNEL REQUIREMENTS PER DAY(a)

Labor Category	Day Shift	Evening Shift	Night Shift
Administrative	1	-	-
Clerical	1	-	-
Operator-Maintenance	2-3	2-3	2-3
Drivers	3	2	-

Note: a) As operations are 7-days per week, add up to 2.5 persons for operator-maintenance position and 1.5 persons for driver positions, relative to a 5-days per week operation.

3.0 PRELIMINARY ENVIRONMENTAL IMPACT ASSESSMENT

3.1 RAW MATERIALS ACQUISITION

The FGE process will be designed with sufficient flexibility to accept varying proportions of "woody" residues and agricultural residues. Thus, plant operations will accommodate local production of these commodities. Consequently, FGE operations within the residue supply area will not cause any regional environmental degradation additional to existing forestry and agricultural operations.

Additional discussion regarding the environmental consequences of residue harvest is presented in such documents as those prepared by the U.S. Office of Technology Assessment (1980 a, b) and by the U.S. Forest Service (1980).

3.2 ATMOSPHERIC RESOURCES

3.2.1 Climate

The area's microclimate may be affected slightly as a result of water vapor released from various plant processes (e.g., cooling tower emissions). This could induce local ground fog or surface icing within several hundred feet of the site on cold mornings.

3.2.2 Air Quality

Boiler house emissions will comply with federal atmospheric emission standards. The cumulative rate of emissions of volatile organic carbons will not cause significant degradation in local air quality. With proper plant design, siting and operation, distillation odors should not result in a public nuisance.

3.3 WATER RESOURCES

3.3.1 Facility Water Requirements

The facility operations will use either an existing municipal water supply or develop new surface or groundwater sources. In the first case, the water consumed will be paid for in accordance with the pertinent price schedule. In the second case, plant siting studies will identify legally available water supplies. The firm will then prepare and submit to the DNRC the necessary applications for consumption of the necessary volumes of surface and/or groundwaters.

3.3.2 Water Quality

The plant wastewater streams will be acidic (pH≈ 5) and be high in BOD_5, COD, and suspended solids. The concentration of such potential pollutants will be affected by the degree of effluent recycling provided and type of waste water treatment applied prior to discharge. Toxic organic and metallic priority pollutants are not expected to be problematic. As stated in subsection 2.2.4.2, the combined settling-biooxidation-chemical treatment of the combined waste streams will be sufficient to meet Montana Pollution Discharge Elimination System (MPDES) stipulations regarding quality of the effluent discharged from the site boundaries.

3.4 SOLID WASTE GENERATION

The combustible solid wastes (e.g., lignins) will be recycled for use as boiler fuel. The ash residues from coal combustion and water-wastewater treatment sludges will be stored (at least temporarily) on-site in holding/evaporation ponds. Other solid wastes will be collected for later transfer to a local landfill for disposal.

3.5 SOCIOECONOMIC CONCERNS

3.5.1 Social and Economic Issues

3.5.1.1 Public Attitudes

A survey of public sentiment towards the siting and operation of the FGE facility would be implemented once the project area is selected. All three of the potential areas are searching for opportunities to expand their revenue and employment bases. Thus, it is probable that economic benefits will be perceived locally as outweighing any foreseeable environmental detriments resulting from project implementation.

3.5.1.2 Economic Impacts

Facility construction will stimulate the local economy. The process may utilize local contractors and create about 44 temporary jobs. Some local purchases of building materials, equipment, etc., will occur. Favorable indirect, or "derivative", effects induced by project and worker expenditures will also occur.

The direct, long-term beneficial effect will be taxation revenues. An indirect effect will be the provision of reliable renewable energy into the local area. As the facility will be owned by a taxable entity, some revenues from ethanol production and corporate property taxes are envisioned. Increases in personal taxes coming from construction personnel will be insignificant. However, long-term increases are envisioned--given the probability of new, permanent jobs created by this project.

3.5.1.3 Population Impacts

It is probable that most of the construction-related labor either can be filled from the local area or regionally. Furthermore, most of the permanent employment will be derived from the local area. Therefore, no significant changes in the "baseline" population base are expected.

3.5.1.4 Public Service Impacts

The perceived lack of significant population increases eliminates concern over demand for additional general government services (e.g., law enforcement, fire protection, schools). However, increased, short-term maintenance of the local road system during construction may be necessary. Although construction-related vehicles will not exceed road limits (i.e., regarding vehicle weight, width, and length), increased road use will contribute slightly to its deterioration. Movement of plant inputs and outputs will be done by truck over local roads also. Some sites, such as Livingston, could have ready access to rail service, whereas some others, such as Lincoln, would not. Plant siting would consider rail proximity and the minimization of truck traffic impacts on local traffic patterns. The combination of increased truck traffic, control of fugitive (roadway) dust, plus concern for the safety of construction workers and local residents, will require appropriate maintenance of, and traffic control on, the affected roads.

The long-term economic impact of the FGE operations will be beneficial. Revenues to the city where the plant is located could be used to expand or improve municipal services without raising local property taxes. Following completion of construction, the system would create no appreciable demand for public services. Several possible exceptions include the need for additional wastewater treatment and/or fire and hazardous material spill control using the services of the existing local fire department.

3.5.1.5 Private Service Impacts

Minor, beneficial impacts on the local economy would occur during project construction. The benefits accrued from wages passing through the private (business) sector, and payments for the purchase of certain equipment and building supplies, will aid the local economy. Overall, the perceived demand for most of the required goods and services can be met locally, without disruption of "baseline" economic and social patterns.

3.5.1.6 Energy Consumption and Related Development

Petroleum product wholesalers should have no problem in supplying diesel fuel, gasoline, and lubricants to construction equipment and associated personal vehicles. Although the FGE production is small, project implementation will contribute to local energy self-sufficiency. The operating system would provide an example of environmentally benign, cost-effective means of liquid fuel production using renewable resources.

3.5.2 Land Use Issues

3.5.2.1 Ownership

The siting study would identify candidate sites in the project area, wherein potential conflicts between project implementation and any existing or proposed resource management-development plan can be avoided or cost-effectively mitigated.

3.5.2.2 Land Use Impacts

The plant site would be located in an area zoned for light industrial activities. The facility design and operations will be compatible with appropriate performance standards (e.g., noise, odors) and other zoning controls, such as landscaping. The operator firm will cooperate with the city-county planning board to ensure compliance with those regulatory measures pertinent to project design and implementation.

The FGE production and associated facilities will be sited in such manner that adverse effects on existing or potential commercial or light industrial developments will be negligible. The two effects foreseen are:

- Exclusion of alternate land uses within and near the plant boundary's right-of-way during the construction and reclamation phases; and
- Exclusion of alternate land uses at the FGE production site, the utility corridor and certain access roads for the project's duration.

Although not considered as environmentally or socio-economically degrading, the FGE facility construction, operation, and maintenance could constitute a nuisance to any especially sensitive residents residing adjacent to the project area.

Specific siting considerations will include these major criteria:

- Presence of an adequate landfill site for disposal of fly ash;
- Proximity to rail service or major highways for shipping and receiving;
- Presence of nearby residential areas;
- Adequate zoning regulations to ensure minimum impact; and
- Consideration of groundwater conditions.

3.5.3 Impacts on Other Resources

3.5.3.1 Earth Resources

The geoedaphic resources and constraints of the site and adjacent areas will be described and evaluated during the formal siting study. The final engineering design and construction plans will be responsive to such concerns. Thus, impacts of project implementation on soil and geologic conditions will be addressed and mitigated as possible.

3.5.3.2 Biological Resources

The terrestrial and aquatic biota present within and adjacent to the project site will be described and evaluated during the formal siting study. If any species designated as threatened or endangered, or associated critical habitat is identified as being present, an alternative site will be considered. If a species of special interest or concern is identified by the State of Montana, the potential mitigating measures will be evaluated for feasibility and cost-effectiveness. In a worst case, another of the area's candidate sites will be selected for detailed examination.

3.5.3.3 Cultural Resources

The various candidate sites will be screened via literature review and consultation with Montana State Historic Preservation Office (MSHPO) personnel to identify sites of potential interest. Subsequent field investigations will verify the presence or absence of archaeological, historical, or paleontological artifacts. If previously unknown sites or objects are discovered at depth during the construction phase, the MSHPO will be notified. In such a case, the resource(s) uncovered will be appropriately salvaged and documented prior to continuing with project construction.

3.5.3.4 Visual Resources

The project site will probably be located on gently sloping to nearly flat terrain that has been disturbed previously by human activities. Even under "worst case" conditions, only short-term, slight-to-negligible adverse aesthetic impacts will occur. The combination of noise, dust, and presence of heavy equipment operations may annoy some local residents and other persons passing by or residing near the project site. New structures will be introduced onto the landscape, and small areas of denuded soil will be exposed until revegetation/landscaping efforts take effect.

Plant characteristics that will be considered in assessing impacts on visual resources for the potential sites will include the height of cooling towers and the visibility of water vapor emissions. Mitigating measures to reduce visual impacts could include various buffer and screening methods (set-back, trees).

3.6 WORKER AND PUBLIC HEALTH AND SAFETY

3.6.1 Occupational Safety and Health

Workers at the FGE plant may be exposed to leaks in the plant's steam lines, fumes from gasohol blending and storage, particulate and gaseous emissions, odors, noise from plant machinery, and accidents due to negligence or the improper use of process equipment (Watson et al., 1982). Proper plant design along with protective equipment and worker (safety) training will help to reduce or to eliminate these problems.

3.6.2 Public Safety and Health

The major public health concern (from FGE operations) is the release of combustion products from the boiler operations. The use of in-state, low-sulfur coal and proper fuel-firing will minimize SO_2 and NO_x emissions; a cyclone will capture 80-85 percent of the fly ash. The likelihood of acceleration of heart and respiratory diseases due to FGE operation is judged to be negligible. The increased evaporative (fuel) losses and elevated aldehyde emissions generated by "gasohol"-using vehicles can be mitigated effectively by catalytic converter installation (Medsker, 1982).

The partial on-site treatment of process effluents followed by dilution (by receiving waters), or further treatment off-site, should mitigate any adverse degradation of existing water quality conditions. Appropriate storage and handling of the process solid wastes will also avoid concerns regarding degradation of air and water quality.

4.0 REGULATORY AGENCY PERMITTING, LICENSING, AND PROJECT REVIEW AUTHORITY

4.1 OVERVIEW

The FGE production facility will require an operating permit from the U.S. Department of Treasury's Bureau of Alcohol, Tobacco, and Firearms (BATF). Fuel produced at the facility must be registered also with the U.S. Environmental Protection Agency (EPA). The present design does not indicate the need for discharge permits for water and waste. Initial evaluation of air emissions indicate that a Prevention of Significant Deterioration review, and probably permit compliance, will be necessary for the 2.5 Mgpy plant. The plant as presently conceived will not exceed New Source Performance Standards, and Ambient Air Quality Standards do not appear to be a problem. Upon completion of final design, applications will have to be made to the State of Montana regulatory agencies to determine permitting requirements. Occupational Safety and Health (OSHA) indoor noise and emission standards must be complied with. Any use of a new surface water or groundwater supply must be predicated upon the pertinent certificate of water right.

4.2 FGE PRODUCTION AND HANDLING

4.2.1 Bureau of Alcohol, Tobacco, and Firearms (BATF)

The BATF administers federal laws and regulations that govern the production, denaturation, distribution, and taxation of fermentation alcohol. The forms generally required to be prepared and submitted to the assistant regional commissioner are presented in Table 4-1. Specific regulatory requirements for completion of these forms, taken from pertinent sections of 27CFR200 et seq., are attached as Appendix A-1.

4.2.2 Environmental Protection Agency (EPA)

Manufacturers of "motor vehicle gasoline" must register their products with the EPA before they may be sold (40CFR79,80). Presumably, a ten percent alcohol-gasoline mixture would be considered a motor vehicle gasoline for the purposes of these regulations. However, fuels which are in a research and development or test status or which are sold only to automobile or engine manufacturers for test purposes, and which are not offered commercially to the public are exempt from the registration requirement.

Applicants for registration must submit information regarding additives, hydrocarbon composition, sulfur and trace element contents, vapor pressure, distillation temperatures, octane number, and, to the extent known, public health effects and toxicity of combustion emissions. The registrant may be required to conduct tests regarding health effects and emissions.

Quarterly production reports must be submitted.

TABLE 4-1.--BATF FORMS GENERALLY REQUIRED TO BE PREPARED FOR QUALIFICATION OF A DISTILLED SPIRITS PLANT.

Form Number	Title
ATF Form 3A	Idemnity Bond
ATF Form 1534 (5000.8)	Power of Attorney
ATF Form 1602	Consent
ATF Form 2601 (5110.56)	Distilled Spirits Bond
ATF Form 2603 (5110.25)	Application for Operating Permit Under 26 U.S.C. 517(b)
ATF Form 2607 (5110.41)	Registration of Distilled Spirits Plant
ATF Form 2625 (5000.9)	Personnel Questionnaire--Alcohol and Tobacco Products
ATF Form 4805 (1740.2)	Supplemental Information on Water Quality Considerations--Under 33 U.S.C. 1341(a)
ATF Form 4871 (1740.1)	Environmental Information
ATF Form 5100.1	Signing Authority for Corporate Officials

Additional Documents	Comments
A plat of the premises	See 27CFR 201.154
Organizational documents	See 27CFR 201.148
Registration of trade names	See 27CFR 201.146
Statement of title	See 27CFR 201.151

Sources: U.S. Department of Energy, 1980; Larry Meier, personal communication.

4.3 ATMOSPHERIC RESOURCES

4.3.1. Federal Regulations and Permits

All air quality permitting for industrial facilities in Montana, such as the FGE plant, is administered through the Department of Health and Environmental Sciences (DHES), Air Quality Bureau (AQB). Permitting for both federal and State of Montana requirements is handled jointly since Montana has EPA approved programs for administering all permitting required by the Federal Clean Air Act (42 USC 1857 et seq.).

4.3.1.1 New Source Performance Standards (NSPS)

The NSPS will not apply to the proposed (FGE) industrial boiler operations as: 1) heat input will not exceed either the "utility threshold" of 25 MBtu/hr. or "ICI threshold" of 100 MBtu/hr. (Siegel and Petrillo, 1984); and 2) the sole product will be process steam, not electricity (40 CFR 60.40; 44 FR 33580).

The proposed coal characteristics and presumed boiler combustion stoichiometry result in SO_2 and NO_x emission rates, as shown in Table 2-3, of ~ 1.4 lbs/MBtu and ~ 0.75 lbs/MBtu, respectively.

In regards to particulate (fly ash) control, the proposed use of a cyclone exhibiting 85 percent operating efficiency will reduce such emissions to about 0.85 lbs/MBtu. The proposed industrial-commercial-institutional (ICI) limit is 0.05 lb/MBtu (Siegel and Petrillo, 1984). However, this ICI limit will not be applicable, given the site of the proposed boiler operations. There are no present regulations that indicate source emissions will be a problem.

4.3.1.2 Prevention of Significant Deterioration (PSD)

Table 2-3 indicates that presently envisioned boiler emissions will constitute a "major source" of both particulate and SO_2, i.e., 178.5 and 293 tons per year (tpy), respectively. A "major source" is defined for these purposes having potential emissions exceeding 100 tpy of any statutory pollutant emitted from a "listed" source--in this case, a coal-fired steam plant.

Once an operation is determined to be a major source for any pollutant for which ambient standards currently are being met, PSD review applies to all pollutants which will be emitted by the source. These requirements often (but not always) include one year of pre-application monitoring of ambient air quality, and an air quality impact analysis based on monitoring or modeling. The objective is to determine the extent of anticipated impacts of the facility operations on ambient air quality. In addition, Best Available Control Technology (BACT) would be required for all pollutants.

The Federal Clean Air Act sets PSD increments for SO_2 and particulates as shown in Table 4-2. These increments are measured against a baseline determined by the date of the first PSD permit application in the air quality control region. If the results of the PSD review and modeling warrant, control requirements more stringent than the NSPS discussed previously could be mandated.

TABLE 4-2.--PREVENTION OF SIGNIFICANT DETERIORATION IN AIR QUALITY: ALLOWABLE INCREMENTS IN ug/m^3 (43 FR 26405).

Pollutant[a,b]	Class I	Class II	Class III
Particulates:	ug/m^3		
Annual geometric mean	5	19	37
24-hour average	10	37	75
SO_2			
Annual arithmetic mean	2	20	40
24-hour average	5	91	182
3-hour maximum	25	512	700

Notes: a) All values other than annual averages may be exceeded once per year.

b) No pollutant concentrations may exceed national ambient air quality standards.

In general, major new sources must satisfy a number of requirements including the following:

- Application of best available control technology (BACT) for control of pollution;
- Compliance with all applicable emission standards;
- Demonstration that the source will not violate ambient air quality standards or allowable (PSD) increments;
- Continuous monitoring of ambient air quality by the operator;
- Analysis by the operator on projected impacts on visibility, soils, vegetation, economic growth, etc.; and
- Public hearings on the proposed facility.

Application review by the State of Montana will determine which of the above may be required.

4.3.1.3 Ambient Air Quality Standards

Federal Ambient Air Quality Standards are shown in Table 4-3. Not withstanding the NSPS and PSD increment considerations (discussed above), these ambient concentrations cannot be exceeded.

Whether these ambient standards or the PSD increments are limiting constraints depend on the specific locality of the proposed facility and the existing baseline ambient air quality in the region. In general, PSD increments are the limiting factors for particulates and SO_2 unless baseline concentrations are near, but not exceeding, the ambient standard(s).

TABLE 4-3.--NATIONAL AMBIENT AIR QUALITY STANDARDS[a]

	Primary Standard	Secondary Standard
Particulate		
24-hour average	260 µg/m^3[b]	150 µg/m^3[b]
Annual geometric mean	75 µg/m^3	60 µg/m^3
Sulfur Dioxide		
3-hour average	--	0.5 ppm (1300 µg/m^3)[b]
24-hour average	0.14 ppm (365 µg/m^3)[b]	--
Annual average	0.03 ppm (80 µg/m^3)	--
Carbon Monoxide		
1-hour average	35 ppm (40 mg/m^3)[b]	35 ppm
8-hour average	9 ppm (10 mg/m^3)[b]	9 ppm
Ozone		
1-hour average	0.12 ppm (235 µg/m^3)[b,c]	0.12 ppm
Nitrogen Dioxide		
Annual average	0.05 ppm (100 µg/m^3)	0.05 ppm
Lead		
Calendar quarter	1.5 µg/m^3	1.5 µgm^3
Hydrocarbons		
3-hour concentration	0.24 ppm (160 µg/m^3)[d,b]	--

Notes:
a) 40 CFR Part 50
b) Not to be exceeded more than once per year
c) 44 FR 8202
d) Guideline only

If Federal ambient standards are already exceeded, the area is designated a non-attainment area for specific pollutants. In such non-attainment areas, new sources would not be allowed unless a corresponding decrease in the pollutant of concern is achieved in the area. This is referred to as an emission offset. The applicant for a permit must provide for reduction in existing emissions of the non-attainment pollutant in the area; such reduction must achieve a sufficient improvement in ambient concentrations of that pollutant, even after the new source is in operation.

4.3.2 Montana State Regulations and Permits

Montana's air pollution control program is established in the Clean Air Act of Montana (75-2-101 et. seq., MCA), which is designed to satisfy the requirements of the Federal Clean Air Act, as amended. Montana has been delegated primary enforcement responsibility by the Environmental Protection Agency, although variances, hazardous emissions, certain new source performance monitoring, and some other special procedures are subject to EPA approval.

4.3.2.1 Permit Procedures

Permits are required for both construction and operation of a pollutant source. Pre-construction permits are required for emission-producing equipment associated with chemical plants, biological materials processing and from fossil fuel-fired boilers. Construction permit applications must be filed with the Montana DHES at least 180 days before commencement of construction (Harrison, 1983).

The general air quality permit process which must be followed is shown in Figure 4-1. Although DHES will prepare an Environmental Assessment (as stipulated by MEPA; 75-1-01 et. seq., MCA) prior to awarding permits, it does not follow necessarily that an Environmental Impact Statement must be prepared. The Montana Ambient Air Quality Standards alluded to in Figure 4-1 are presented in Table 4-4.

Applications for operation permits must be filed at least 120 days prior to operation and must be accompanied by plans, specifications, process descriptions, and any other information required by DHES. DHES has 30 days to determine if the application is complete. Once a complete application is received, DHES has 60 days to make its decision or up to 180 days if an environmental impact statement must be prepared. Any person adversely affected by a DHES decision may, within 15 days, request a hearing before the Board of Health under the provisions of the Administrative Procedure Act. Board decisions may be appealed within 30 days to district court. If construction is not completed within two years after the permit is granted, a new permit will be required.

Permits will be granted only after a showing that the facility will not violate ambient air and emission limitation standards. The Air Quality Bureau of DHES may require the applicant to provide sampling and monitoring facilities. Before granting an operation permit, the Air Quality Bureau must find that the facility was constructed and installed in accordance with the conditions imposed by the construction permit.

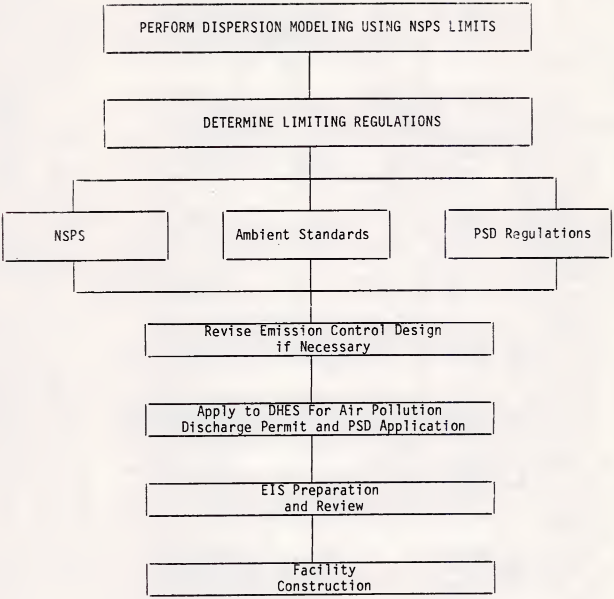

PERFORM DISPERSION MODELING USING NSPS LIMITS
DETERMINE LIMITING REGULATIONS
NSPS
Ambient Standards
PSD Regulations
Revise Emission Control Design if Necessary
Apply to DHES For Air Pollution Discharge Permit and PSD Application
EIS Preparation and Review
Facility Construction

FIGURE 4-1.--AIR QUALITY PERMITTING PROCESS

TABLE 4-4.--MONTANA AMBIENT AIR QUALITY STANDARDS

(Montana Department of Health and Environmental Sciences,
Air Quality Rules, 1982).

CO	
8-hour average	9 ppm[a]
Hourly average	23 ppm[a]
H_2S	
Hourly average	.05 ppm[a]
Lead	
Calendar quarter average	1.5 $\mu g/m^3$
NO_2	
Hourly average	0.30 ppm[a]
Annual average	0.05 ppm
Ozone	
Hourly average	0.10 ppm[a]
Settled Particulate Matter	
30-day average	10 g/m^2
SO_2	
Hourly average	0.50 ppm[b]
24-hour average	0.10 ppm[a]
Annual average	0.02 ppm
Suspended Particulate Matter	
24-hour average	200 $\mu g/m^3$[a]
Annual average	75 $\mu g/m^3$

Visibility

Annual average particulate scattering coefficient of 3×10^{-5}/m.
Applicable only to designated PSD Class I areas.

Notes:
a) Not to be exceeded more than once per year.
b) Not to be exceeded more than 18 times in any 12 consecutive months.

4.3.2.2 Equipment Malfunctions

Malfunctions which will increase emissions and will continue for more than 24 hours must be promptly reported to the Air Quality Bureau. The AQB may approve continuation of operations for up to ten days. Additional time may be granted for major equipment failures if a corrective program is submitted and approved. All malfunctions lasting for four hours must be reported within seven days; reporting will include information related to volume of excess emissions caused, corrective actions, proposed or implemented, etc.

4.3.2.3 Variances

The Board of Health and Environmental Sciences may, after public hearing, grant variances from emission limits or other standards. Such variances are reviewed annually for renewal. A fee is assessed for a variance application based on the cost of the equipment which would be required to bring the facility into compliance with the rule from which the variance is sought. The fee is applied to the cost of hearings, preparation of an environmental impact statement, and other expenses incurred by the application.

4.3.2.4 Emergency Episodes

Montana's emergency episode plan is designed for emergency control of particulates and sulfur dioxide. There are four air pollution episode stages: forecast, alert, warning, and emergency. At the forecast stage, major pollution sources are notified that an atmospheric stagnation advisory is in effect. As pollutant concentrations rise, increasingly more stringent enforcement actions may be taken. These actions can range from partial to complete [illegible]tion source operations. Enforcement orders will remain in effect until ambient pollutant concentrations fall below the emergency episode levels

4.3.2.5 Pertinent Montana State Emission Standards

4.3.2.5.1 Odors

Emissions of gases, vapors, or odors must be controlled so as not to create a public nuisance. Operations which discharge odor-causing material into the outdoor atmosphere must install and maintain odor control devices or treatment procedures as specified by the Air Quality Bureau.

If a public nuisance is created, the operation may be required to tightly close and ventilate the facility so that all odoriferous emissions are eliminated.

4.3.2.5.2 Sulfur Oxides (Sulfur in Fuels)

Liquid or solid fuels containing sulfur in excess of one pound per million Btu fired may not be burned. Gaseous fuel containing sulfur compounds in excess of 50 grains per 100 cubic feet of fuel may not be burned.

4.3.2.5.3 Visible Contaminants

Visible air contaminants darker than #2 on the Ringelmann Chart or of a greater opacity are prohibited from any installation. No single source may discharge any air contaminants darker than #1 Ringelmann or of a greater opacity. If the presence of uncombined water (i.e., steam) is the only reason for noncompliance, these rules do not apply.

4.3.2.5.4 Particulate Emissions from Industrial Processes

Particulate emission limits, given in Table 4-5, do not apply to fuel burning equipment, incinerators, fossil fuel-fired steam generators, or sewage treatment plants if Federal New Source Performance Standards have been adopted for such sources.

4.3.2.5.5 Particulate Emissions from Fuel Burning Equipment

Discharges of particulate matter by fuel combustion from stacks or chimneys may not exceed the hourly rates (Table 4-5). Heat input is calculated as the aggregate heat content of all fuels whose combustion products pass through the stack or chimney. When two or more fuel burning units are connected to a single stack, their combined heat input shall not exceed that allowable for the same unit connected to a single stack.

4.3.2.5.6 Airborne Particulate Emissions (Fugitive Dust)

Material handling, storage, or transporting shall not cause particulate matter to become airborne. Buildings, roads, driveways, or open areas (e.g., loading docks, freight yards) may not be constructed, used, repaired, or demolished unless all reasonable measures to prevent airborne particulates have been taken. Such measures include paving, frequent cleaning of roadways, application of dust-free surfaces or of water, and maintenance of vegetative ground cover.

TABLE 4-5.--PARTICULATE EMISSION LIMITS FOR INDUSTRIAL PROCESSES

Process Weight Tons/Hr	Emissions lbs/Hr	Process Weight Tons/Hr	Emissions lbs/Hr	Process Weight Tons/Hr	Emissions lbs/Hr
0.05	0.551	2.50	7.58	25.00	35.4
0.10	0.877	3.00	8.56	30.00	40.0[a]
0.20	1.40	3.50	9.49	35.00	41.3
0.30	1.83	4.00	10.4	40.00	42.5
0.40	2.22	4.50	11.2	45.00	43.6
0.50	2.58	5.00	12.0	50.00	44.6
0.75	3.38	6.00	13.6	60.00	46.3[b]
1.00	4.10	8.00	16.5	70.00	47.8
1.25	4.76	9.00	17.9	80.00	49.0
1.50	5.38	10.00	19.2	100.00	51.2
1.75	5.96	15.00	25.2	500.00	69.0
2.00	6.52	20.00	30.5	1000.00	77.6
				3000.00	92.7

Notes: a) Interpolation for process rates up to 60,000 lbs. (30 Tons) per hour shall be accomplished by using the equation:

E = 4.10 P**0.67

b) For process weight rates in excess of 60,000 lbs. (30 Tons) per hour, use the equation:

E = 55.0 P**0.11 - 40, where

E = Emission Rate in Pounds Per Hour.
P = Process Weight Rate in Tons Per Hour.

Source: 16.8.1403 ("Particulate Matter, Industrial Processes"), Administrative Rules of Montana

4.3.3 County Regulations and Permits

Neither Lewis and Clark (Lincoln site) nor Deer Lodge (Anaconda site) Counties have local air quality standards, while burning permits are required in Park County (Livingston), (Harrison, 1983).

4.4 WATER RESOURCES

4.4.1 Water Rights

A water rights permit to consume water for FGE production is required in all cases where surface water will be used, or if a groundwater source with a maximum appropriation of 100 gpm or more will be used (85-2-301 et seq., MCA).

The operator firm will acquire and complete the Beneficial Water Use Permit application, Form No. 600; this form can be acquired from the local Water Rights Bureau field office of the Montana Department of Natural Resources and Conservation (re: 85-2-307 through 317, MCA; 36.12.102, ARM). This form requires the following information: 1) the applicant's source of water supply; 2) the legal (land) description for the applicant's point of diversion and place of use; 3) the applicant's means of diversion, including conduit type and pump size; 4) the amount of water requested in terms of gpm and acre-feet per year; 5) the beneficial use(s) to which the water will be put; and 6) a map showing the location of all pertinent activities. A copy of the Form No. 600 R4/82 is attached as Appendix A-2 to this report.

The Bureau also requires the applicant to meet a certain burden of proof for specific criteria before the permit can be issued. Furthermore, any groundwater development completed outside the boundaries of any established controlled groundwater area will require a certificate of water right (85-2-306, MCA). In such a case, Form No. 602 (Notice of Completion of Groundwater Development) must be completed and submitted to the pertinent DNRC field office. Information requirements are essentially the same as those discussed for Form No. 600 R4/82 (Harrison, 1983).

4.4.2 Effluent Discharge Permit(s)

In Montana and other states with EPA-approved water quality control programs, the recognized state agency is responsible for administering the National Pollution Discharge Elimination System (NPDES), the Section 401 Permit (certification), and the New Source Performance Standards (NSPS) for water. The lattermost standards will not apply to the proposed FGE operations.

4.4.2.1 Montana Pollutant Discharge Elimination System (MPDES)

The MPDES satisfies the requirements of the Federal Water Pollution Control Act (33 USC 1344 Section 401). It is unlawful, without a current permit, to construct or operate a disposal system or any sewage or waste discharge outlet which discharges into the waters of the state. The permit system applies only to point sources of pollution. Any wastewater holding or settling pond which is designed to, or may, discharge into state waters would be considered a point source requiring a permit from the DHES. Water impoundments which will not discharge into state waters are not subject to permit requirements. However, if such facilities have adverse impacts on groundwater quality (especially on aquifiers used as public water supplies), the DHES has authority to take whatever action is necessary to abate such impacts. Such holding ponds and other impoundments should be designed in consultation with DHES's Water Quality Bureau to avoid groundwater degradation.

In order for an entity (private or public) to discharge liquid wastes into surface waters of the state, the entity must obtain a MPDES permit from DHES. Information required in the permit application includes:

- Background flow and quality information on the receiving stream;
- Quality and flow information on the discharge;
- Process and treatment information; and
- Map(s) of point(s) of discharge.

Application must be made at least 180 days in advance of the proposed operation. The application must contain facility plans, soil conditions, operating procedures, and any other information which the DHES deems necessary. Supplemental reports may be required for new sewage systems, treatment works, etc. or extensions of such facilities. Reports on sewage systems, treatment works, and sewage disposal systems should contain (as a minimum) the information outlined in the "Recommended Standards for Sewage Works" as adopted by the Great Lakes-Upper Mississippi River Board of State Sanitary Engineers. The application will not be processed by DHES until all required information has been received.

After the completed application is received, DHES makes a tentative determination based on effluent standards, performance standards, water quality standards, toxic and hazardous substance standards, and existing area-wide water treatment plans. If tentatively approved, a draft permit is issued which contains effluent limits, compliance schedules, operating conditions, monitoring requirements, etc. If discharges will be 500,000 gallons per day or more (or in other appropriate circumstances), DHES will prepare a fact sheet.

Subsequently, a public notice of the draft permit is issued and a 30-day comment period is provided during which time requests for a public hearing are received. After the comment period and hearing (if any), the final determination is made. Permit approval requires the concurrence of the EPA regional administrator in Denver. Permits are effective for up to five years and reissuance follows similar procedures. If DHES decides to modify, deny, suspend, or revoke a permit, opportunity for a hearing before the Board of Health must be provided. All decisions by the Board may be appealed to district court. An applicant's trade secrets may be designated confidential by declaratory judgement of the court.

4.4.2.2 Section 401 Permit

Since Montana operates an EPA-approved water quality program, DHES issues the Section 401 (of the Federal Clean Water Act) permit. This permit is only issued if the project requires other federal permits and will discharge into navigable waters. The permit is a certification by DHES that the discharge will comply with the applicable provisions of the Federal Clean Water Act, Sections 301, 302, 303, 306, and 307. Information needs on the application are similar to those for the MPDES permit.

Section 301 of the FWPCA established target dates for achieving effluent discharge controls. By July 1977, point sources other than publicly owned treatment works were to apply "best practicable control technology currently available," and public treatment works were to utilize secondary treatment techniques. By July 1983, point sources other than public treatment works were to apply "best available technology economically achievable." Such works were to achieve elimination of pollution discharges if technologically and economically possible; publicly owned sewage treatment works were to apply "best practicable waste treatment technology."

Section 302 provides that, where necessary to maintain water quality standards and to protect public water supplies, fish and wildlife, and agricultural needs, more stringent effluent limitations must be applied. Areas in which current effluent limitations are insufficient to maintain acceptable water quality are given priority ranking, and maximum daily pollutant loads are established at levels necessary to achieve acceptable water quality (§ 303(d)). New sources of pollution in various industrial categories are required to apply "best available demonstrated control technology, processes, operating methods, or other alternatives, including, where practicable... no discharge of pollutants," (§ 306(a) (1)). Control of toxic substances discharge also is established (§ 307). Amendments to the law in 1977 extended the deadlines for compliance with many of these standards.

4.4.2.3 Industrial Effluent Standards

4.4.2.3.1 Pretreatment Standards (40 CFR 128)

When wastewaters are discharged into municipal sewage systems using publicly owned wastewater treatment works, such wastes are subject to pretreatment standards. Federal pretreatment standards apply to "major contributing industries." These industries are users of publicly owned treatment works which:

- Have an average daily flow of 50,000 gallons of wastewater; or
- Have a flow greater than five percent of the total volume carried by the municipal system;
- Have toxic (priority) pollutants in their waste; or
- Have significant impact on the existing treatment works, as determined by the pollution discharge permit agency.

The following wastes may not be introduced into the public system:

- Wastes which create fire or explosion hazards;
- Wastes which will cause corrosive or structural damage to the treatment works (e.g., pH lower than five);
- Solid or viscous wastes in amounts which would obstruct the sewers or otherwise interfere with the operation of the treatment works; and
- Wastes discharged at excessive flow rates over short periods of time.

Pertinent effluent standards are presented in Table 4-6. Except as required by the criteria above, special pretreatment is not required for "compatible pollutants." These pollutants include chemical oxygen demand; total organic carbon; phosphorus and its compounds; nitrogen and its compounds; and fats, oils, or grease of animal or vegetable origin.

For "non-compatible pollutants" (i.e., all those not listed as "compatible"), pretreatment standards are established in effluent limitation guidelines. These guidelines define the best practicable control technology for appropriate pollution source categories.

The pretreatment standards described above and listed in the effluent guidelines are minimum requirements. State and local authorities may require more stringent controls, depending on special conditions in the locality. The pertinent treatment works officials must, therefore, be consulted to ascertain special restrictions, once the FGE site has been selected.

4.4.2.3.2 Secondary Treatment Standards (40 CFR 13.3)

Standards applicable to effluents discharged by publicly owned treatment works (after application of secondary treatment as defined by the EPA) are contained in Table 4-7. If discharges by major industrial sources into a public treatment system would interfere with the attainment of these standards, the industrial discharges may be restricted accordingly.

TABLE 4-6.--EFFLUENT STANDARDS PERTINENT TO THE PROPOSED FGE FACILITY

Effluent Characteristics	Effluent Limitations[a,b,c] (Kg/1000 Kg of Product)					
	Maximum 1 Day			30-Day Average		
	A	B	C	A	B	C
Chemical Oxygen Demand (COD)	--	.8	--	--	.58	--
5-Day Biological Oxygen Demand (BOD_5)	.13	.044	.11	.058	.025	.048
Total Suspended Solids (TSS)	.20	.066	.10	.088	.040	.044
pH	Within the 6.0 to 9.0 Range					

Notes: a) Standards are expressed in three ways:
- A. Pollutant level after application of best practicable control technology currently available;
- B. Effluent reduction attainable by application of best economically available control technology; and
- C. New Source Performance Standards.

b) Industrial sources may not discharge substances into surface waters which will settle, float, produce odor or color, create toxic concentrations, or create conditions which would produce undesirable aquatic life.

c) Storm drainage, storm sewage discharges, and non-point source pollution should be eliminated or minimized.

TABLE 4-7.--SECONDARY TREATMENT STANDARDS FOR PUBLICLY OWNED TREATMENT WORKS[a]

Effluent Characteristic	Effluent Limitations 30-Day Average	 Maximum 7-Day Average
BOD_5	30 mg/l[b]	45 mg/l
TSS	30 mg/l[b]	45 mg/l
pH	6.0 to 9.0	6.0 to 9.0

Notes:
a) Sewage must receive a minimum of secondary treatment; industrial wastes must receive the equivalent of current Best Practicable Control Technology (BPCT) as defined by EPA.

b) Regulated to 15 percent of influent values.

4.4.2.4 Commentary on the Montana Water Quality Standards

Montana has established water quality standards for all river basins throughout the state (A.R.M. 16-2.14(10)-S14480). These standards have been approved by EPA and provide the fundamental rationale for all other aspects of the pollution control program. Effluent limitations, maximum load requirements, and waste treatment planning must be designed to meet these water quality standards.

The water quality standards adopted by the Board of Health and Environmental Sciences require the best practicable treatment and control of waste, its characteristics, and flow in order to maintain water quality at the highest possible level. The degree of waste treatment required is determined on a case-by-case basis and is based on considerations that include the state's non-degradation policy, present and anticipated beneficial uses of the water, the quality and nature of water flow, the quantity and quality of the discharge, and the presence or absence of other pollution (discharge) sources.

4.4.2.5 Authorization for Short-Term Exemption from the Turbidity (Water Quality) Standard

The authorization is applicable to those situations involving instream activities associated with road, bridge, or other forms of construction. This requirement can be waived if the operator obtains a "310 Permit" from the local conservation district (subsection 4.6.1.2) and the Montana DFWP does not specifically require the authorization.

This authorization is a conditional exemption from turbidity standards, pursuant to the Montana Water Quality Act (75-5-101 et seq., MCA) and associated rules (i.e., 16.20.633(3)(a), ARM). Its purpose is to regulate necessary, short-term and unavoidable violation of Montana State's turbidity standard, despite application of best engineering/construction practices. The pertinent form entitled "Application for Short-Term Exemption from Surface Water Quality Standards for Construction Activity" may be obtained from the DHES, Helena.

4.5 SOLID WASTE HANDLING AND DISPOSAL

The Solid Waste Management Bureau of the DHES is responsible for administering the state's solid waste and hazardous waste management programs. These programs are designed to comply with the requirements of the Federal Resource Conservation and Recovery Act (42 USC 6901 et seq.) as amended. The FGE facility will comply also with all pertinent state and local laws and regulations, as well as with EPA guidelines (40 CFR 241: Guidelines for Land Disposal of Solid Wastes; 40 CFR 243: Guidelines for the Storage and Collection of Residential, Commercial and Industrial Solid Waste). This compliance must recognize the requirements of the Montana Solid Waste Management Act (74-10-201 et seq., MCA).

Coal combustion wastes, water/wastewater treatment sludges and gypsum sludge are listed as being non-hazardous; thus they are exempt from the hazardous waste regulations. Furthermore, the EPA has decided not to propose solid waste regulations specific to alcohol fuel plants (Hira et al., 1983).

4.5.1 On-Site Disposal of Non-Hazardous Wastes

The disposal of non-hazardous solid wastes on-site can require a license from the DHES. This requirement does not apply if the property area is at least five acres in size. If necessary, the owner of the FGE facility would complete and submit an application pursuant to 75-10-201 through 233, MCA, and ARM 16.14.501 through 526. DHES regulations list criteria including applicant's name and address; legal and general description of the facility; site selection (i.e., size, access, water pollution potential, geoedaphic and hydrologic data, land use and zoning constraints); and proposed operating/maintenance/supervision plans. The EPA publication entitled Sanitary Landfill Design and Operation can be referred to for guidance in completing the application.

Within 15 days after receipt of an application, the DHES must notify the local health officer who has jurisdiction in the area where a proposed solid waste facility is to be located. The DHES also notifies the local health officer in writing if it decides to issue a license. The license is not valid until signed by the local health officer who must decide whether or not to validate it within 15 days. Issuance or validation of a license may be refused or revoked by DHES or the local health officer only on a finding that the facility will not comply, or is not complying, with the requirements of this law or any rules adopted by DHES under this law. Such decisions can be appealed to the Board of Health within 30 days.

4.5.2 Off-Site Disposal of Non-Hazardous Wastes

If the operator decides to dispose of wastes off-site, then a facility licensed to handle the wastes will need to be arranged or developed. All three counties of interest operate Class II landfills which could handle such wastes. However, they could refuse to accept the wastes if the volume is considered to be excessive. Thus, once the FGE site is selected, negotiations with the pertinent county officials should occur early in the final design phase. A determination would be made then as to whether the existing system could accept the waste quantities expected from plant operations.

In regards to county-wide permitting of sewage and solid waste disposal facilities, Lewis and Clark County has no such regulations, while Deer Lodge County has adopted such regulations. In Park County, an on-site sewage disposal permit is required (Harrison, 1983).

4.6 OCCUPATIONAL HEALTH AND SAFETY CONSIDERATIONS

4.6.1 Occupational Safety and Health Act (29 USC 688 et seq.)

OSHA established workplace practices to protect the health and safety of workers. The Act is enforced through inspections of workplaces and issuance of compliance orders, rather than by permit system. As the FGE project will be privately owned, then all OSHA regulations would apply, including the inspection and enforcement responsibilities.

4.6.1.1 Construction

Worker health and safety during construction would be covered by the OSHA Construction Standards. These standards are common in the construction industry. The FGE facility would not present any particularly notable hazards during the construction phase.

4.6.1.2 Operation

OSHA regulations applicable to steam generation facilities will probably apply to the thermal plant. These OSHA regulations establish workplace exposure limits and guidelines for non-ionizing radiation; hazardous materials (including compressed gases and flammable liquids); and toxic and hazardous emissions (including arsenic, benzene, as well as several other organic compounds which may result from coal combustion). Also regulated are noise and fire hazards. The nature of workplace hazards associated with fermentation processes are fairly well defined (Watson et al., 1982). Thus, the applicable OSHA standards will be identified and complied with.

4.6.2 Montana Regulations and Permits

Programs designated to protect the health and safety of workers and to regulate noise and emissions in the workplace are jointly administered by the Occupational Health Bureau in the DHES, the Health and Safety Bureau of the Worker's Compensation Division (WCD) in the state Department of Labor and Industry, and the Occupational Safety and Health Administration in the U.S. Department of Labor (OSHA).

DHES monitors occupational conditions, conducts on-site inspections, and surveys all workplaces for excesses of dust, gases, mist, noise, lighting, and heat; conducts biological sampling; and inspects dust gas control systems and ventilation.

4.6.2.1 Pertinent Standards

4.6.2.1.1 Air Contaminants

Montana DHES regulations set maximum allowable emission levels for an extensive list of air contaminants in the workplace. The complete list is presented in Table I from 16.42.102, ARM.

4.6.2.1.2 Noise

There are no generally applicable outdoor environmental noise limitations in effect in Montana. Local governments may establish noise regulations as part of their zoning ordinances. These regulations will be checked locally, once the FGE site is identified.

Montana DHES regulations regarding workplace noise levels are presented in Table 4-8.

4.6.2.1.3 Worker Safety

The Montana Safety Act, administered by the Health and Safety Bureau of the Workers Compensation Division of the Department of Labor and Industry, requires

TABLE 4-8.--MAXIMUM ALLOWABLE NOISE LEVELS AS ESTABLISHED BY THE MONTANA DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCE

Duration (hrs/day)	Sound Level (dBA)
8	90
6	92
4	95
3	97
2	100
1-1/2	102
1	105
3/4	107
1/2	110
1/4 or less	115

Source: 16.42.101 ("Occupational Noise"), Administrative Rules of Montana.

employers to provide safe working conditions in conformance with the standards adopted under the Federal Occupational Safety and Health Act (29 CFR 1903 et seq.). The Montana statute provides for periodic inspections by the Bureau and authorizes the issuance of enforcement orders. Variances from standards may be granted if a worker's safety is not endangered thereby. Under federal law, federal agencies must consult with the Secretary of Labor in designing an occupational health and safety program and assuring the adequacy of federal facilities.

4.6.2.2 Permits

The Board of Health establishes conditions for permits for the installation, alteration, or operation of machines and equipment which may contribute to occupational disease. The Board must make its decision on a permit within 90 days of receipt of the completed application.

4.6.2.3 Inspection, Enforcement and Penalties

4.6.2.3.1 Fire Inspection

Building plans are reviewed by the State Fire Marshall. Buildings designed for public, commercial, or industrial occupancy must meet a number of requirements. These requirements relate to fire extinguishers; fire escapes; building structure and materials; exits; alarm systems; flue and chimney requirements; heating devices; electrical wiring and equipment; air conditioning; ventilating systems; refrigeration systems; flammable liquids; rubbish; open flame devices; vehicle parking; dust explosions; lightning protection; and other special fire hazards. The Fire Marshall issues permits and conducts inspections periodically.

Fire Marshall Bureau regulations have adopted by reference the standards promulgated by the National Fire Protection Association (McKinnon and Turner, 1976), the U.S. Bureau of Standards, and the American Insurance Association.

4.6.2.3.2 Enforcement and Penalties

Whenever the DHES becomes aware of a violation, it may serve a notice and order on the violator and may require the violator to appear before the Board. Within 30 days of the order, the violator may, on his own, request a Board hearing. The Board will then affirm, modify, or revoke the DHES order. The Board's decision is judicially reviewable. Penalties up to $1,000 per day may be levied.

4.6.2.3.3 Boiler Inspection

Internal and external boiler inspection must occur as specified in Section 2.4.30.703 of the Administrative Codes of Montana. The owner/operator will prepare the boiler for inspection by a state inspector or special boiler inspector as discussed in 24.30.724, ARM. An operating certificate is valid only if the boiler, "for which it was issued continues to be inspected by an authorized insurance company or until the expiration date" (24.30.714, ARM).

4.7 PERMITTING AND REGULATORY REVIEW OF SOCIOECONOMIC CONCERNS AND OFF-SITE ACTIVITIES

Off-site activities associated with the FGE plant will have impacts which must be considered. These activities may include construction of water diversion system pipelines to bring in water, construction or upgrading of roads and rail spurs, erection of electric power lines, etc. Land disturbances and other impacts caused by these activities may be reviewed under the laws which follow. Given the lack of an exact site, many of the regulations, etc., discussed below may not be applicable. Therefore, only an overview of the particular regulatory process is discussed.

4.7.1 Streambed Disturbance

4.7.1.1 Corps of Engineers Dredge-and-Fill Permit

A 404 Permit, obtained from the U.S. Army Corps of Engineers, is required for a project if dredge-and-fill activities occur either in a stream with a flow greater than 5 cfs or in a wetland. In the case of an FGE facility, a 404 Permit will be required if a surface water intake structure is utilized.

4.7.1.2 The "310" Permit

Any physical alteration or modification of a natural, perennial-flowing stream or its bed or banks that results in a change of state of geohydrologic conditions (required for project implementation) will require receipt of a "310" permit. The operator (of the FGE) would then comply with the provisions set forth in the Natural Streambed and Land Preservation Act (75-7-100 et seq., MCA). In such case the firm would complete and submit to the MDNRC a copy of Form No. 270 R182, "Natural Streambed and Land Preservation Act, Notice of Proposed Project."

4.7.1.3 Flood Plain Development Permit

In most cases, the location of a FGE production facility within designated boundaries of the 100-year flood plain will require a Flood Plain Development Permit. In addition, the developer may have to prepare and submit a request to establish or alter an existing floodplain obstruction or implement some nonconforming use of the floodplain (Harrison, 1983).

4.7.2 Soil and Water Conservation Districts

Conservation district supervisors may, after approval by the voters in the district, adopt land-use regulations in the interest of conserving soil and water resources and preventing and controlling erosion. If adopted, the regulations have the force of law and may include provisions requiring engineering projects, cultivation or grazing methods, retirement of highly erosive areas, and other activities as necessary to carry out the purpose of the Streambed and Land Preservation Act. The regulations must be uniform throughout the district. However, lands may be classified with respect to soil types, drainage, erosion, etc., and regulations may vary according to the land classification.

4.7.3 Electric Utility Lines

4.7.3.1 Right-of-Way Occupancy Considerations

All public utilities and all common carrier pipelines have the authority to use public right-of-way. However, proposals must be reviewed by the Department of Highways to achieve maximum public use of right-of-ways while protecting public safety and avoiding conflicts between utility needs and transportation needs. These regulations apply only to the federal aid highway systems and do not apply to utilities operated by local governments within city limits, unless utility lines are proposed on federal aid right-of-ways. The Highway Department reviews utility proposals for conformance with minimum safety standards for proper drainage, vegetation maintenance, debris control, traffic protection, and scenic enhancement.

The utility submits a notice of proposed right-of-way occupancy, including plans and location, to the appropriate Field Maintenance Bureau Chief. If the plans conform to the standards set forth in the regulations, the bureau chief will approve them. If not, he will return the plans with written comments. The utility may resubmit the corrected plans or appeal the decision to the Board of Highway Appeals.

4.7.3.2 Construction of Utility Lines

Authorization is given to electric and telephone public utilities to construct lines along public streets and roads. Lines in new service areas must be constructed underground if it is technically and economically feasible. City councils may regulate the erection of poles and cables within city limits.

City or town councils and boards of county commissioners have permit authority for laying water, gas, and sewer mains under streets, alleys, and roads. City councils regulate the construction of electric lines and poles. The Montana Administrative Rules establish standards for construction of power lines, poles, and insulation. The National Electric Safety Code, promulgated by the U.S. Department of Commerce, applies to such lines; the Montana Public Service Commission is responsible for its enforcement.

4.7.4 Highway Right-of-Way Activities

4.7.4.1 Excavations

Written approval must be obtained from the pertinent board of county commissioners, county road supervisor, or county surveyor for excavation or construction across public highways.

4.7.4.2 Approach Permits

Construction of approaches to public highways must be approved by the state Department of Highways. The request is made to the chief of the appropriate Field Maintenance Bureau, and a brief description of the proposed project, including site plan, etc., is submitted. The applicant meets with the bureau chief to discuss the project. If significant environmental impact is anticipated, the applicant may be required to include an environmental impact statement along with the application. Furthermore, if the project is to be located in an area of traffic congestion, the bureau chief must submit the application to the Department of Highways for approval. Department regulations include standards and requirements for design, use, materials, construction methods, and inspection of highway approaches and access driveways.

4.7.5 Historical/Cultural Resources

The Montana Antiquities Act, revised in 1979, pertains to "state actions or state assisted or licensed action." The Act requires that heritage properties (i.e., significant historic, archaeological, and architectural properties) and paleontological remains situated on state lands be identified and protected (Harrison, 1983). The sequence of compliance can be categorized into three procedural steps including: 1) identification of historical/cultural resources within the project's area of potential environmental impact; 2) for those properties identified, assess their significance in terms of integrity, historic association, artistic merit, or ability to yield important information on prehistoric lifeways; and 3) presentation of means to mitigate potential impact of the development on the significant attributes of the identified properties.

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APPENDIX A-1

APPENDIX B

Department of Treasury Bureau of Alcohol, Tobacco, and Firearms

Permit Information

- Alcohol Fuels and BATF
- Regulatory Requirements
- BATF Regional Offices
- Sample Application for Experimental Distilled Spirits Plant

ALCOHOL FUELS AND BATF

The Bureau of Alcohol, Tobacco, and Firearms (BATF) is responsible for administering federal laws and regulations governing the taxation, production, denaturation, and distribution of fermentation ethanol. They have the responsibility to make available, in an understandable format, the information required by prospective ethanol producers and users so that they can comply with current laws and regulations.

The information required to qualify a distilled spirits plant for commercial production of ethanol has been summarized in BATF publication 5000.1, which is available at the BATF Regional Office. This convenient publication provides the applicable regulations and pertinent information to prospective producers and distributors of ethanol for commercial fuel ventures. Many citizens, however, are not interested in going into the fuel business; but instead, want to produce fermentation ethanol as a supplemental fuel for their own use. They want to make themselves more self-sufficient and reduce their fuel bills. This section will provide the information needed to qualify with BATF requirements to produce ethanol for individual use.

Who Can Qualify?

Under Title 27, Code of Federal Regulations, Section 201.64, **anyone** may establish an experimental distilled spirits plant for experimentation in, or development of:

- sources of material from which spirits may be produced;
- processes by which spirits may be produced or refined; or
- industrial uses of spirits.

Since "home production" of ethanol for use as an alternate fuel is a new concept, the BATF can and will approve the establishment of experimental plants by individuals who are seeking to prove the merit of this idea. There is no BATF application form to fill out; a letter written by the individual with certain pertinent information is presented. The information required in this letter includes natur and purpose, description of plant premises, description of production process and equipment, security, and rate production. Explanations of these items follow.

Nature and Purpose

A general statement describing what is intended is required. For example, the applicant wants to produce fermentation ethanol which will be used as fuel for farm engines and heaters; including, but not limited to, tractors, combines, swathers, cars, trucks, irrigation motors, houses, grain dryers, etc.; or, the applicant intends to experiment with waste products (corn cobs, stalks, spoiled grain) to produce fermentation ethanol to determine if it can be refined and used as a fuel to run farm implements; or, the applicant intends to build a still which can efficiently refine fermentation ethanol produced from waste products for ultimate use as a fuel.

Description of Plant Premises

Describe the location of the premises where the experimental plant will be established. If the applicant is a farmer, this should include the entire farm so that the ethanol produced may be used without removing it from the "plant premises." The description should include the number of acres involved. The buildings used in the production and storage of ethanol (if applicable) and their relative location on the farm should be described.

Description of Production Process and Equipment

The production process to be used should be described. For example, "mash to be fermented will consist of spoiled grain, vegetables, and kitchen garbage. Initial distillation of fermentation ethanol will be accomplished by solar energy. Ethanol recovered from the mash via the still will be refined in a still of my own manufacture." A descriptive list of the equipment used in the process should be given. All equipment from the mash tank to the finished ethanol storage tank should be included. In addition, when and how the ethanol produced will be denatured should be described; i.e., "ethanol will be mixed with gasoline in a 10:1 ratio immediately after production. This will be done in the fuel storage tank."

Security

Security measures to be provided for the ethanol produced should be described. For example, "ethanol will be stored in a 1,500-gallon fuel tank which is equipped for locking with a padlock; or, ethanol will be immediately denatured, drummed off, then stored in a locked shed. All windows in the shed are equipped with security screens and two watchdogs are on the premises."

Rate of Production

The amount of ethanol expected to be produced in an average 15-day period must be stated. This may be estimated. The average proof of the finished ethanol produced must be given. For example, "approximately 400 gallons of ethanol, averaging between 160–190 proof, will be produced in a 15-day period."

The completed letter application must be filed with the Regional BATF Office. They will examine it for completeness then forward it to one of their field officers for inspection. A BATF inspector will visit the proposed plant prior to the time *formal* authorization to operate is given. The facilities will be examined and the applicant will be advised of the record requirements for the operation. The inspector will also discuss the authorized operations and answer any questions. The inspector will supply blank bond forms (F-2601) and inform the applicant of the dollar amount of coverage required. [Form 2601 is a surety bond which is executed by the applicant as the principal and an approved insurance company as the surety. The amount of the bond will depend upon the type and volume of operations to be conducted. It is the BATF estimate of the *potential* tax liability on the spirits produced. The rate of tax liability is $10.50 per proof gallon (1 gallon of 100-proof spirits). No tax is actually paid for ethanol produced or used on the experimental distilled spirits plant. However, the bond coverage is still necessary to ensure the protection of the tax liabilities which attach to all spirits produced.] See the sample Form 2607 which follows.

The BATF inspector will also deliver Forms 4805 and 4871 (relating to water quality considerations and environmental information, respectively) which can be completed and returned to the BATF inspector during his/her visit. After the BATF Regional Office receives a favorable inspection report and a properly executed bond, they will issue a formal authorization to begin operations. This authorization, however, does not exempt the applicant from complying with any state and local requirements concerning the production of fermentation ethanol.

The following questions and answers are presented to clarify certain points relative to the experimental distilled spirits plant application and operation.

1. **Question:** Can I sell or loan any excess ethanol produced to another person for fuel use?

Answer: No. The ethanol produced may be used as fuel only at the plant premises described in your bond and letter application. Only a plant qualified as a commercial distilled spirits plant (DSP) can sell, loan, or give ethanol to another party.

2. **Question:** Can I remove some of the ethanol from the plant premises for my own use? (For example, as a fuel for my personal car.)

Answer: You may remove ethanol from your plant premises for your own use as a fuel; however, the ethanol must be *completely* denatured according to one of the two formulas listed below before removal.

Formula No. 18. To every 100 gallons of ethanol add:
2.5 gallons of methyl isobutyl ketone;
0.125 gallon of pyronate or a compound similar thereto;
0.50 gallon of acetaldol; and
1 gallon of either kerosene or gasoline.

or

Formula No. 19. To every 100 gallons of ethanol add:
4.0 gallons of methyl isobutyl ketone; and
1.0 gallon of either kerosene or gasoline.

3. **Question:** Must I denature the ethanol before using it on my farm?

Answer: While BATF can approve applications where good cause is shown for the need to use undenatured spirits as fuel, they prefer that you denature your ethanol with gasoline, diesel fuel, or heating fuel immediately after production. This will allow BATF to approve less stringent security systems and recordkeeping requirements than what they impose on applicants who do not denature their ethanol.

4. **Question:** Can any of the ethanol produced be used for beverage purposes?

Answer: Absolutely not. Besides the IRS Excise Tax of $10.50 per proof gallon, for which you would become liable, you could also incur severe criminal penalties.

5. **Question:** Can I build my distillery system prior to receiving any authorization from BATF to operate?

Answer: Yes. However, you must file an application to establish an experimental distilled spirits plant with BATF immediately after its completion. You may, however, file sooner if you feel you will have the equipment set up prior to the qualification visit by the BATF inspector. However, under no circumstances may you start producing spirits prior to receipt of a formal authorization by the BATF.

6. **Question:** Can I qualify two or more farms for my plant premises?

Answer: Yes, if they are in close proximity to each other so as to allow a BATF inspector to inspect all premises without causing undue travel and administrative difficulties.

7. **Question:** How long a period is the authorization effective?

Answer: BATF is currently approving operations for a 2-year period unless you include in your application some justification for a longer period of time.

8. **Question:** Can I renew my experimental plant authorization after expiration?

Answer: Yes. When the authorization expires, you may file a new application listing the current information on all subjects originally described (security, rate of production, equipment, etc.). A new bond will not be required unless significant changes in operations have occurred since the original filing.

9. **Question:** Can partnerships and corporations make application as well as individuals?

Answer: Yes, however, if the application is filed by a partnership, all partners must sign it. If it is filed by a corporation, a person authorized by the corporation must sign and proof of such authorization must accompany the application (e.g., a certified copy of a corporate resolution or an abstract of bylaws giving such authority).

10. **Question:** Can I convert to a commercial operation?

Answer: There is no simple means of converting an experimental operation into a commercial operation. Normally, all provisions of Title 26, U.S.C. Chapter 51 and Title 27, CFR Part 201 will be waived for an experimental ethanol fuel-related DSP except for those relating to:

(1) filing application for, and receiving approval to operate an experimental DSP for a limited, specified period of time;

(2) filing of a surety bond to cover the tax on the ethanol produced;

(3) attachment, assessment, and collection of tax;

(4) authorities of BATF Officers; and

(5) maintenance of records.

No such blanket waiver will be given for commercial operations. The applicant will have to follow the qualification procedure outlined in BATF P 5000.1. BATF will, however, give favorable consideration to alternate procedures from regulations which do not present a definite jeopardy to the revenue; however, each such variation will be viewed and ruled upon on an individual basis.

Hopefully, changes in the law and regulations to facilitate the qualification of commercial plants will occur within the next 2 years. BATF also has proposed simpler permit applications for small-scale fermentation ethanol plants producing fuel; however, they have not yet been approved.

REGULATORY REQUIREMENTS

The Specific Regulatory Requirements of the Bureau of Alcohol, Tobacco, and Firearms are provided on the following pages.

Applicable Excerpts From 27 CFR Part 201— Distilled Spirits Plants

Subpart F—Qualifications of Distilled Spirits Plants

§201.131 General requirements for registration.

A person shall not engage in the business of a distiller, bonded warehouseman, rectifier, or bottler of distilled spirits, unless he has made application for and has received notice of registration of his plant with respect to such business as provided in this part. Application for registration shall be made on Form 2607 to the assistant regional commissioner. Each application shall be executed under penalties of perjury, and all written statements, affidavits, and other documents submitted in support of the application or incorporated by reference shall be deemed to be a part thereof. The assistant regional commissioner may, in any instance where the outstanding notice of registration is inadequate or incorrect in any respect, require by registered or certified mail the filing of an application on Form 2607 to amend the notice of registration, specifying the respects in which amendment is required. Within 60 days after the receipt of such notice, the proprietor shall file such application.

(72 Stat. 1349, 26 U.S.C. 5171, 5172)

§201.132 Data for application for registration.

Application on Form 2607 shall be prepared in accordance with the headings on the form, and instructions thereon and issued in respect thereto, and shall include the following:

(a) Serial number and statement of purpose for which filed.

(b) Name and principal business address of the applicant, and the location of the plant if different from the business address.

(c) Statement of the type of business organization and of the persons interested in the business, supported by the items of information listed in §201.148.

(d) Statement of the business or businesses to be conducted.

(e) In respect of the plant to which the Form 2607 relates, a list of applicant's operating and basic permits, and of the qualification bonds (including those filed with the application) with the name of the surety or sureties for each bond.

(f) List of the offices, the incumbents of which are authorized by the articles of incorporation or the board of directors to act on behalf of the proprietor or to sign his name.

(g) Plat and plans (see §§201.154–201.159).

(h) Description of the plant (see §201.149).

(i) List of major equipment (see §201.147).

(j) As applicable, the following:

(1) With respect to the business of a distiller:

(i) Statement of maximum proof gallons that will be *(a)* produced during a period of 15 days and *(b)* in transit to the bonded premises. (Not required if the qualification bond is in the maximum sum.)

(ii) Statement of daily producing capacity in proof gallons.

(iii) Statement of process (see §201.153).

(iv) Statement whether denaturing operations will be conducted.

(v) Statement of title to the bonded premises and interest in the equipment used for the production of spirits, accompanied where required by consent on Form 1602 (see §§201.151–201.152).

(2) With respect to the business of a bonded warehouseman:

(i) Statement of the maximum proof gallons that will be stored on, and in transit to, the bonded premises. (Not required if the qualification bond is in the maximum sum.)

(ii) Description of the system of storage, and statement of storage capacity (bulk, packages, and cases).

(iii) Statement whether denaturing and/or bottling-in-bond operations will be conducted.

(3) With respect to the business of a rectifier, a statement of the maximum tax the rectifier will be liable to pay under sections 5021 and 5022, I.R.C., in a 30-day period. (Not required if the qualification bond is in the maximum sum.)

(4) With respect to the business of bottling after tax determination:

(i) Statement of the name, address, and plant number of a plant qualified by the applicant for production or bonded warehousing. (Not required if the plant being registered is qualified for production, bonded warehousing, or rectification, or if the applicant is a State or political subdivision thereof.)

(ii) Statement whether operations involving bottling in bond after tax determination, as provided in § 201.114, will be conducted.

(5) With respect to any other business to be conducted on the plant premises, as provided by Subpart D of this part, a description of such business, a list of the buildings and/or equipment to be used, and a statement as to the relationship, if any, of such business to distilled spirits operations at the plant.

Where any of the information required by paragraph (c) or paragraph (g) of this section is on file with the assistant regional commissioner, such information, if accurate and complete, may, by incorporation by reference thereto by the applicant, be made a part of the application for registration. The applicant shall, when so required by the assistant regional commissioner, furnish as a part of his application for registration such additional information as may be necessary for the assistant regional commissioner to determine whether the application for registration should be approved.

(72 Stat. 1349; 26 U.S.C. 5171, 5172)
[25 FR 6053, June 30, 1960, as amended by T.D. 6749, 29 FR 9896, July 23, 1964; T.D. 7112, 36 FR 8571, May 8, 1971]

§201.133 Notice of registration.

The application for registration, when approved, shall constitute the notice of registration of the plant. A plant shall not be registered or reregistered under this subpart until the applicant has complied with all requirements of law and regulations relating to the qualification of the business or businesses in which the applicant intends to engage. A plant shall not be operated unless the proprietor has a valid notice of registration covering the businesses and operations to be conducted at such plant. In any instance where a bond is required to be given or a permit is required to be obtained with respect to a business or operation before notice of registration of the plant may be received with respect thereto, the notice of registration shall not be valid with respect to such business or operation in the event that such bond or permit is no longer in effect and an application for reregistration shall be filed and notice of registration again obtained before thereafter engaging in such business or operation at such plant; reregistration is not required when a new bond or a strengthening bond is filed pursuant to §201.191 or §201.212.

(72 Stat. 1349; 26 U.S.C. 5171, 5172)

§201.135 Powers of attorney.

The proprietor shall execute and file with the assistant regional commissioner a Form 1534, in accordance with the instructions on the form, for every person authorized to sign or to act on behalf of the proprietor. (Not required for persons whose authority is furnished in the application for registration.)

(72 Stat. 1349; 26 U.S.C. 5172)

§201.136 Operating permits.

Except as provided in §201.138, every person required to file an application for registration under §201.131 shall make application for and obtain an operating permit before commencing any of the following operations:

(a) Distilling for industrial use.

(b) Bonded warehousing of spirits for industrial use.

(c) Denaturing spirits.

(d) Bonded warehousing of spirits (without bottling) for nonindustrial use.

(e) Bottling or packaging of spirits for industrial use.

(f) Any other distilling, warehousing, or bottling operation not required to be covered by a basic permit under the Federal Alcohol Administration Act (49 Stat. 978; 27 U.S.C. 203, 204). Application for such operating permit shall be made on Form 2603 to the assistant regional commissioner.

(72 Stat. 1349, 1370; 26 U.S.C. 5171, 5271)

§201.137 Data for application for operating permits.

Each application on Form 2603 shall be executed under the penalties of perjury, and all written statements, affidavits, and other documents submitted in support of the application shall be deemed to be a part thereof. Applications on Form 2603 shall be prepared in accordance with the headings on the form, and instructions thereon and issued in respect thereto, and shall include the following:

(a) Name and principal business address of the applicant.

(b) Plant address, if different from the business address.

(c) Description of the operation to be conducted for which an operating permit must be obtained.

(d) Statement of type of business organization and of the persons interested in the business, supported by the items of information listed in §201.148.

(e) Trade names (see §201.146).

(f) On specific request of the assistant regional commissioner, furnish a statement showing whether the applicant or any of the persons whose names and addresses are required to be furnished under the provisions of §201.148(a)(8) and (c) has—(1) ever been convicted of a felony or misdemeanor under Federal or State law, (2) ever been arrested or charged with any violation of State or Federal law (convictions or arrests on charges for traffic violations need not be reported as to subparagraphs (1) and (2) of this paragraph, if such violations are not felonies), or (3) ever applied for, held, or been connected with a permit, issued under Federal law to manufacture, distribute, sell, or use spirits or products containing spirits, whether or not for beverage use, or held any financial interest in any business covered by any such permit, and, if so, give the number of classification of such permit, the period of operation thereunder, and state in detail whether such permit was ever suspended, revoked, annulled, or otherwise terminated.

Where any of the information required by paragraph (d) of this section is on file with the assistant regional commissioner, the applicant may, by incorporation by reference thereto, state that such information is made a part of the application for an operating permit. The applicant shall, when so required by the assistant regional commissioner, furnish as a part of his application for an operating permit such additional information as may be necessary for the assistant regional commissioner to determine whether the applicant is entitled to the permit.

(72 Stat. 1349, 1370; 26 U.S.C. 5171, 5271)

§201.138 Exceptions to operating permit requirements.

The provisions of §201.136 shall not apply to any agency of a State or political subdivision thereof, or to any officer or employee of any such agency acting for such agency.

(72 Stat. 1349, 1370; 26 U.S.C. 5171, 5271)

§201.147 Major equipment.

The following items of major

equipment, if on the plant premises, shall be described in the application for registration:

(a) Mash tubs and cookers (serial number and capacity).

(b) Fermenters (serial number and capacity).

(c) Tanks used in the production, storage, denaturation, rectification, bottling, and measurement of spirits and tanks used in the storage and the measurement of denatured spirits (designated use (or uses), serial number, capacity, and method of gauging or measurement).

(d) Permanently installed scales and other measuring equipment (including meters).

(e) Bottling lines (list separately as to use and serial number).

(f) Stills (serial number, kind, capacity, and intended use). (The capacity shall be stated as the estimated maximum proof gallons of spirits capable of being produced every 24 hours, or (for column stills) may be represented by a statement of the diameter of the base and number of plates.)

(g) Other items of fixed equipment used in the production, storage, rectification and or bottling of spirits, if valued at $5,000 or more (description and use).

The description shall show, as to each item of equipment, the location thereof in the plant, and the premises (bonded or bottling) and the facility (production, storage, denaturation, or bottling on bonded premises, and rectification or bottling on bottling premises) in which it is to be used. Where any equipment is to be used in two or more facilities, it shall be identified as for multiple use, and its use in each facility shall be shown.

(72 Stat. 1349; 26 U.S.C. 5172)

§201.148 Organizational documents.

The supporting information required by paragraph (c) of §201.132, and paragraph (d) of §201.137, includes, as applicable:

(a) *Corporate documents.* (1) Certified true copy of articles of incorporation and any amendments thereto.

(2) Certified true copy of the corporate charter or a certificate of corporate existence or incorporation.

(3) Certified true copy of certificate authorizing the corporation to operate in the State where the plant is located (if other than that in which incorporated).

(4) Certified list of directors and officers, showing their names and addresses.

(5) Certified true copy of bylaws.

(6) Certified extracts or digests of minutes of meetings of board of directors, authorizing certain individuals to sign for the corporation.

(7) Statement showing the number of shares of each class of stock or other evidence of ownership, authorized and outstanding, the par value thereof, and the voting rights of the respective owners or holders.

(b) *Articles of partnership.* True copy of the articles of partnership or association, if any, or certificate of partnership or association where required to be filed by any State, county, or municipality.

(c) *Statement of interest.* (1) Names and addresses of the 10 persons having the largest ownership or other interest in each of the classes of stock in the corporation, or other legal entity, and the nature and amount of the stockholding or other interest of each, whether such interest appears in the name of the interested party or in the name of another for him. If a corporation is wholly owned or controlled by another corporation, those persons of the parent corporation who meet the above standards are considered to be the persons interested in the business of the subsidiary, and the names thereof need be furnished to the assistant regional commissioner only at his request.

(2) In the case of an individual owner or partnership, name and address of every person interested in the plant, whether such interest appears in the name of the interested party or in the name of another for him.

(72 Stat. 1349, 1370; 26 U.S.C. 5172, 5271)

[25 FR 6053, June 30, 1960. Redesignated at 40 FR 16835, Apr. 15, 1975, and amended by T.D. ATF-29, 41 FR 36492, Aug. 30, 1976]

§201.149 Description of plant.

The application for registration shall include a description of each tract of land comprising the plant, clearly indicating the bonded premises, the bottling premises, and any other premises to be included as part of the plant. In the case of a plant producing spirits, where the premises subject to tax lien under section 5004(b), I.R.C., are not coextensive with the bonded premises, the tract of land on which any building containing any part of the bonded premises is situated shall also be described. The description of each tract of land subject to lien under section 5004(b), I.R.C., shall be by courses and distances, in feet and inches (or hundredths of feet), with the particularity required in conveyances of real estate. If any area (or areas) of the plant is to be alternated between bonded and bottling premises, as provided in §201.175, each such area shall be described, and shall be identified by number or letter. The description of denaturing facilities (and equipment) shall show the manner of segregation of such facilities from other facilities which prevents contamination of undenatured spirits. Each building and outside tank shall be described (location, size, construction, arrangement, and means of protection and security), referring to each by its designated number or letter, and use. If a plant consists of a room or floor of a building, a description of the building in which the room or floor is situated and its location therein shall be given.

(72 Stat. 1349; 26 U.S.C. 5172)

§201.150 Registry of stills.

The provisions of Part 196 of this chapter are applicable to stills located on plant premises. The listing of stills for distilling in the application for registration, and the approval of the application for registration, shall constitute registration of such stills.

(72 Stat. 1349, 1355; 26 U.S.C. 5172, 5179)

§201.151 Statement of title.

The application for registration shall include a statement setting forth the name and address of the owner in fee of the lot or tract of land subject to lien under section 5004(b)(1), I.R.C., the buildings thereon, and the equipment used for the production of spirits. If the applicant is not the owner in fee of such property, or if such property is encumbered by mortgage or other lien, the application for registration shall be accompanied by a consent on Form 1602, as provided in §201.152, unless indemnity bond on Form 3A is filed, as provided in §201.200.

(72 Stat. 1349; 26 U.S.C. 5172)

§201.152 Consent on Form 1602.

Consents on Form 1602, where required by this subpart, shall be executed by the owner (if other than the proprietor) of property subject to lien under section 5004(b)(1), I.R.C., and by any mortgagee, judgment creditor, or other person having a lien on such property, duly acknowledging that the property may be used for the purpose of distilling spirits, subject to the provisions of law, and expressly stipulating that the lien of the United States, for taxes on distilled spirits produced thereon and penalties relating thereto, shall have priority of such mortgage, judgment, or other encumbrance, and that in the case of the forfeiture of such property, or any part thereof, the title to the same shall vest in the United States, discharged from such mortgage, judgment, or other encumbrance.

(72 Stat. 1349; 26 U.S.C. 5172, 5173)

§201.153 Statement of process.

The statement of process in the application for registration shall set forth a step-by-step description of the process employed to produce spirits, commencing with the treating, mashing, or fermenting of the raw materials or substances and continuing through each step of the distilling, redistilling, purifying and refining processes to the production gauge, and showing the kind and approximate quantity of each material or substance used in producing, purifying, or refining each type of spirits.

(72 Stat. 1349; 26 U.S.C. 5172)

PLAT AND PLANS

§201.154 General requirements.

The proprietor shall submit, as part of his application for registration, a plat of the premises and plans, in triplicate, as required by this subpart.

(72 Stat. 1349; 26 U.S.C. 5172)

§201.155 Preparation.

Each plat and floor plan shall be drawn to a scale of not less than 1/100 inch per foot and shall show the cardinal points of the compass. Each sheet of the drawings shall—

(a) Bear a distinctive title;

(b) Be numbered in consecutive order, the first sheet being designated number 1; and

(c) Have a clear margin of not less than 1 inch on each side and have outside measurements of 15 by 20 inches: *Provided,* That the assistant regional commissioner may authorize the use of larger sheets if they can be satisfactorily filed.

Plats and plans shall be submitted on tracing cloth, sensitized linen, or blueprint paper, and may be original drawings, or, if clear and distinct, reproductions made by lithoprint, ditto, or ozalid processes. The director may approve other materials and methods which he finds are equally acceptable.

(72 Stat. 1349; 26 U.S.C. 5172)

§201.156 Depiction of plant.

The plat shall show the boundaries of the plant, and delineate separately the portions thereof comprising the bonded premises, the bottling premises, and any other premises to be included as a part of the plant, in feet and inches (or hundredths of feet). The delineation of these premises shall agree with the description given in the application for registration.

The plat shall show (a) all buildings on the plant premises, (b) all basic equipment (including tanks and stills) not located in buildings, and (c) all driveways, public thoroughfares, and railroad rights-of-way contiguous to, connecting, or separating the plant premises. Each building, enclosed area, and outside tank shall be identified. Each pipeline for the conveyance of spirits to and from the premises of the plant, and between bonded and bottling premises, shall be shown on the plat in blue, and each pipeline for the conveyance of denatured spirits to and from the premises of the plant shall be shown on the plat in green: *Provided,* That in lieu of such colors, the pipelines may be identified by symbols which permit ready identification of their uses. The purpose for which such pipelines are used and the points of origin and termination shall be indicated on the plat. Where premises on which spirits, wines, or beer are manufactured, stored, or sold are contiguous to a plant, the plat shall show the relative location of the plant and such contiguous premises, and all pipelines and other connections between them (public utility pipelines and similar connections excepted). The outline of such contiguous premises and of the plant shall be shown in contrasting colors. Where a plant consists of less than an entire building, the plat shall show the building, and the land on which such building is situated. Where a plant consists of, or includes, one or more floors or rooms of a building that is not wholly included in the plant, the floors or rooms so used shall be shown on a floor plan. Each floor plan shall show the location and dimensions of the floors or rooms, the means of ingress and egress, and, insofar as required on plats by this section, pipelines and contiguous premises. Where construction of floors or rooms is identical, a typical plan of such floors or rooms will be acceptable. Where the floor plan shows the entire plant and includes all the information required by a plat, such plan may be accepted in lieu of a plat.

(72 Stat. 1349; 26 U.S.C. 5172)

§201.157 Flow diagrams.

Flow diagrams (plans) shall be submitted reflecting the production processes on bonded premises. The flow diagram shall show major equipment (identified as to use) in its relative operating sequence, with essential connecting pipelines (appropriately identified by color) and valves. The flow diagram shall include the entire closed distilling system. Minor equipment (such as pumps, pressure regulators, rotometers) need not be shown. The direction of flow through the pipelines shall be indicated by arrows.

(72 Stat. 1349; 26 U.S.C. 5172)

§201.158 Certificate of accuracy.

The plat and plans shall bear a certificate of accuracy in the lower right-hand corner of each sheet, signed by the proprietor, substantially as follows:

____
(Name of proprietor)
____
(Distilled spirits plant No.)
____
(Address)
Accuracy certified by:
____
(Name and capacity - for the proprietor)
Sheet No. ____ Date ____________

(72 Stat. 1349; 26 U.S.C. 5172)

Subpart G—Bonds and Consents of Surety

§201.191 General.

Every person intending to commence or to continue the business of a distiller, bonded warehouseman, or rectifier, shall file bond, Form 2601, as prescribed in this subpart, with the assistant regional commissioner, at the time of filing the original application for registration of his plant, and at such other times as are required by this part. Such bond shall be conditioned that he shall faithfully comply with all provisions of law and regulations relating to the duties and business of a distiller, bonded warehouseman, or rectifier, as the case may be (including the payment of taxes imposed by chapter 51 I.R.C.), and shall pay all penalties incurred or fines imposed on him for violation of any such provisions. The assistant regional commissioner may require, in connection with any bond on Form 2601, a statement, executed under the penalties of perjury, as to whether the principal or any person owning, controlling, or actively participating in the management of the business of the principal has been convicted of or has compromised any offense set forth in §201.198(a) or has been convicted of any offense set forth in §201.198(b). In the event the above statement contains an affirmative answer, the applicate shall submit a statement describing in detail the circumstances surrounding such conviction or compromise. Once every four years, and as provided in §201.213, a new bond, Form 2601, shall be executed and filed in accordance with the provisions of this subpart. No person shall commence or continue the business of a distiller, bonded warehouseman, or rectifier, unless he has a valid bond, Form 2601 (and consent of surety, if necessary), as required in respect of such business by this part.

(72 Stat. 1349, 1394; 26 U.S.C. 5173, 5551)

§201.200 Indemnity bond, Form 3A.

A proprietor of a plant qualified for the production of spirits may furnish bond on Form 3A to stand in lieu of future liens imposed under section 5004(b)(1), I.R.C., and no lien shall attach to any lot or tract of land, distillery, building, or distilling apparatus by reason of distilling done during any period included within the term of any such bond. Where an indemnity bond has been furnished on Form 3A in respect of a plant, the requirements of this part relating to the filing of consents on Forms 1602 and bonds on Forms 1617 and Forms 4737 are not applicable in respect to such plant.

(72 Stat. 1317, 1349, as amended; 26 U.S.C. 5004, 5173)

[T.D. 7112, 36 FR 8572, May 8, 1971]

§201.211 Bonds and penal sums of bonds.

The bonds, and the penal sums thereof, required by this subpart, are as follows:

Bond	Penal sum		
	Basis	Min.	Max.
(a) Distiller's, Form 2601	The amount of tax on spirits produced in his distillery during a period of 15 days.	$5,000	$100,000
(b) Bonded Warehouseman's, Form 2601:			
(1) General	The amount of tax on spirits (including denatured spirits) stored on such premises and in transit thereto.	5,000	200,000
(2) Limited to storage of not over 500 wooden packages, and to a total of not over 50,000 proof gallons.	do	5,000	50,000
(3) Limited to storage of denatured spirits, denaturation of spirits, and storage of not to exceed 100,000 proof gallons of spirits prior to denaturation.	do	5,000	100,000
(c) Rectifier's, Form 2601	The amount of tax the rectifier will be liable to pay in a period of 30 days under sections 5021 and 5022, I.R.C.	1,000	100,000
(d) Combined Operations, Form 2601:			
(1) Distiller and bonded warehouseman	Sum of penal sums of bonds in lieu of which given.	10,000	200,000
(2) Distiller and rectifier	do	6,000	200,000
(3) Bonded, warehouseman and rectifier.	do	6,000	250,000

(continued next page)

<table>
<tr><th></th><th colspan="3">Penal sum</th></tr>
<tr><th></th><th>Basis</th><th>Min.</th><th>Max.</th></tr>
<tr><td>(4) Distiller bonded warehouseman, and rectifier.</td><td>do</td><td>11,000</td><td>250,000</td></tr>
<tr><td>(5) Distiller and bonded wine cellar.</td><td>do</td><td>6,000</td><td>150,000</td></tr>
<tr><td>(6) Distiller, bonded warehouseman, and bonded wine cellar.</td><td>do</td><td>.11,000</td><td>250,000</td></tr>
<tr><td>(7) Distiller, rectifier, and bonded wine cellar.</td><td>do</td><td>7,000</td><td>250,000</td></tr>
<tr><td>(8) Distiller, bonded warehouseman, rectifier, and bonded wine cellar.</td><td>do</td><td>12,000</td><td>300,000</td></tr>
<tr><td>(e) Blanket bond, Form 2501</td><td colspan="3">The penal sum shall be calculated in accordance with the following table:</td></tr>
<tr><td></td><td>Total penal sums as determined under (a), (b), (c), and (d).</td><td colspan="2">Requirements for penal sum of blanket bond.</td></tr>
<tr><td></td><td>Not over $300.000</td><td colspan="2">100 percent.</td></tr>
<tr><td></td><td>Over $300,000 but not over $600,000.</td><td colspan="2">$300,000 plus 70 percent of excess over $300,000.</td></tr>
<tr><td></td><td>Over $600,000 but not over $1,000,000.</td><td colspan="2">$510,000 plus 50 percent of excess over $600,000.</td></tr>
<tr><td></td><td>Over $1,000,000 but not over $2,000,000.</td><td colspan="2">$710,000 plus 35 percent of excess over $1,000,000</td></tr>
<tr><td></td><td>Over $2,000,000</td><td colspan="2">$1,060,000 plus 25 percent of excess over $2,000,000</td></tr>
<tr><td>(f) Indemnity, Form 3A</td><td>Appraised value of property...</td><td></td><td>$300,000</td></tr>
<tr><td>(g) Indemnity, Form 1617</td><td>Decrease in value of property.</td><td>$5,000</td><td>300,000</td></tr>
<tr><td>(h) Indemnity Bond, Form 4737..</td><td>The amount of involuntary liens against property.</td><td>(1)</td><td>(1)</td></tr>
<tr><td>(i) Withdrawal Bond, Form 2613.</td><td>The amount of tax which, at any one time, is chargeable against such bond but has not been paid.</td><td>1,000</td><td>1,000,000</td></tr>
<tr><td>(j) Withdrawal Bond, Form 2614.</td><td>do</td><td>1,000</td><td>1,000,000</td></tr>
<tr><td>(k) Blanket Withdrawal Bond Form 2615:</td><td></td><td></td><td></td></tr>
<tr><td>(1) Bonded and bottling premises on same plant premises</td><td>Sum of penal sums of bonds, Forms 2613 and 2614, in lieu of which given.</td><td>2,000</td><td>1,000,000</td></tr>
<tr><td>(2) Two or more plants in a region qualified for bonded and or bottling operations.</td><td>Sums of the penal sums of all the bonds, Forms 2613 and/or 2614, in lieu, of which given.</td><td>(2)</td><td>(3)</td></tr>
</table>

[1] Sum of outstanding involuntary lien or liens covered by the bond.

[2] Sum of the minimum penal sums required for each plant covered by the bond.

[3] Sum of the maximum penal sums required for each plant covered by the bond. (The maximum penal sum for one plant is $1,000,000.)

(68A Stat. 847, 72 Stat. 1349, as amended, 1352; 26 U.S.C. 7102, 5173, 5174, 5175)

[25 FR 6053, June 30, 1960, as amended by T.D. 7112, 36 FR 8572, May 8, 1971]

Subpart H—Construction and Equipment

§201.231 Protection of premises.

(a) *Buildings.* The buildings in which spirits are held or stored shall be securely constructed of masonry, concrete, wood, metal, or other equally substantial material, and arranged, equipped, and protected to afford adequate supervision and inspection by internal revenue officers. Except for doors or other openings approved by the assistant regional commissioner, separations between bonded premises and bottling premises shall be secure and unbroken.

(b) *Doors and windows.* Doors to rooms or buildings under the joint custody of the assigned officer and the proprietor shall be so installed and equipped as to prevent their removal and shall be rigidly secure when locked. Windows in such rooms or buildings shall be equipped with sash locks or comparable fasteners. If the location of such windows with respect to the ground, to a fire escape, roof, set back, or balcony, or to an adjacent or contiguous structure would permit ingress to such rooms or buildings or would otherwise, in the opinion of the assistant regional commissioner, create a jeopardy to security, the assistant regional commissioner shall require such windows to be of the detention type equipped with wire glass panes or to be protected by means of iron bars or shutters or other means affording equal protection to the revenue.

(c) *Other openings.* Skylights, monitors, penthouses, and similar roof openings in such rooms or buildings shall be treated as windows for security purposes. Ventilating or heating ducts, or sewerage or drainage openings which would permit ingress to such rooms or buildings, or would otherwise, in the opinion of the assistant regional commissioner, create a jeopardy to the revenue, shall be protected with secure metal grills or other means which the assistant regional commissioner considers to be equally effective.

(d) *Additional security.* Where the assistant regional commissioner finds the construction, arrangement, equipment, or protection inadequate, he shall require additional security to be provided (such as fences, floodlights, alarm systems, watchman services) or changes in construction, arrangement, or equipment to be made to the extent necessary to assure him that the construction, arrangement, or equipment is adequate to protect the revenue.

§201.234 Locking of storage rooms or buildings on bonded premises.

Where spirits are bottled or packaged, or stored in packages or in cases or in other portable containers on bonded premises, the proprietor shall provide a room or building for such bottling, packaging, or storage. Such room or building shall be constructed as provided in §201.231, arranged and equipped so as to be suitable for the intended purpose, and shall be equipped for locking with Government locks. Any other building, room, or enclosure on bonded premises, not secured by Government lock, in which spirits (including denatured spirits) are held, shall be equipped for locking by the proprietor.

§201.236 Identification of structures, areas, apparatus, and equipment.

Each room or enclosed area where spirits (including denatured spirits) or wines, distilling or fermenting materials, or containers are held, and each building, within the plant, shall be appropriately marked as to use. Each tank or receptacle for spirits (including denatured spirits) or wine shall be marked to show its serial number, capacity, and use. Where tanks or receptacles are used for multiple purposes, such uses shall be indicated. Each still shall be numbered and marked to show its use. All other major equipment used for processing or containing spirits (including denatured spirits) or wine, or distilling or fermenting material, and all other tanks, shall be identified as to use unless the intended use thereof is readily apparent.

(72 Stat. 1353; 26 U.S.C. 5178)

§201.238 Government office.

The proprietor shall provide an office at the plant for the exclusive use of Government officers in performing supervisory and administrative duties and safeguarding Government records and property. Such office shall be adequately equipped with office furniture and a secure cabinet fitted for locking with a Government lock and with toilet and lavatory facilities, shall be well lighted, ventilated, and heated, and shall be subject to the approval of the assistant regional commissioner. Where suitable facilities are otherwise available, the assistant regional commissioner may waive the requirements for a separate Government office.

§201.240 Closed distilling system.

The distilling system shall be continuous and closed at all points where potable or readily recoverable spirits are present, and shall be so designed, constructed, and connected as to prevent the unauthorized removal therefrom without detection, of such spirits and of distilling material and stillage from which spirits are readily recoverable. The security of the closed distilling system shall be maintained, and removal of spirits therefrom controlled by Government locks or seals, or by such meters or other devices or methods affording comparable protection as may be approved by the Director. Processing equipment not susceptible of being locked or sealed (a) shall be located in a room or enclosure which shall be in the joint custody of the assigned officer and the proprietor, which room or enclosure shall be locked with a Government lock, and shall not be unlocked or remain unlocked except when such officer is on the plant premises, or (b) shall be otherwise equally protected in a manner approved by the Director. In addition, processing equipment not located within a room or building shall, unless the premises or general area containing such equipment is enclosed within a fence or wall which the assistant regional commissioner deems adequate to the protection of the revenue, be enclosed within a secure fence constructed as provided in §201.243(b). The provisions of this section do not preclude the removal of spirits from the closed distilling system, pursuant to production gauge, and their deposit in bonded storage, by redesignation of the tank in which the production gauge is made as a storage tank, and the necessary locking or sealing of the tank to remove it from the closed system.

(72 Stat. 1353; 26 U.S.C. 5203)

§201.242 Denaturing facilities.

Where the proprietor is authorized to denature spirits, he shall provide on his bonded premises, segregated facilities for use in his denaturing operations. These facilities shall include:

(a) A storage room or rooms, fitted for locking, for storing packages of denaturants, if denaturants are to be received in packages;

(b) Tanks and other suitable receptacles, fitted for locking, for storing denaturants, if denaturants are to be received in bulk quantities;

(c) Tanks, fitted for locking, for denaturing spirits, if spirits are to be denatured in tanks;

(d) Tanks for storing denatured spirits, if denatured spirits are to be stored on bonded premises in tanks; and

(e) Storage space in a room or building for storing packages of denatured spirits, if denatured spirits are to be removed in packages.

The proprietor shall also provide such meters and other equipment and apparatus as may be necessary to carry out proposed operations. Meters, equipment, and facilities used for handling or processing denaturing materials or denatured spirits shall not be used for spirits other than spirits to be denatured: *Provided*, That the assistant regional commissioner may authorize their use for other spirits when he determines that contamination of such other spirits will not take place.

(72 Stat. 1353; 26 U.S.C. 5178)

Applicable Excerpts From 27 CFR Part 211— Distribution and Use of Denatured Alcohol and Rum

Subpart D—Qualification of Bonded Dealers and Users

APPLICATION FOR INDUSTRIAL USE PERMIT

§211.42 Application, Form 1479, for permit to use or recover.

Every person desiring to use specially denatured alcohol or specially denatured rum, or both, and every person desiring to recover denatured alcohol, specially denatured rum, or articles shall, before commencing business, make application for and obtain an industrial use permit, Form 1481. Except as provided in §211.42a, application for an industrial use permit shall be on Form 1479. Such application, and necessary supporting documents as required by this subpart for such permit, shall be filed with the assistant regional commissioner. All data, written statements, affidavits, and other documents submitted in support of the application shall be deemed to be a part thereof. Such application shall be accompanied by evidence which will establish the authority of the officer or other person who executes the application to execute the same and, where applicable, by the application for a withdrawal permit, Form 1485, required by §211.161.

(72 Stat. 1370; 26 U.S.C. 5271)
[T.D. 7058, 35 FR 14395, Sept. 12, 1970]

§211.43 Data for application, Forms 1474* and 1479.

Each application on Form 1474* or 1479 shall include, as applicable, the following information:

(a) Serial number and purpose for which filed.

(b) Name and principal business address of applicant.

(c) Location of the dealer's or user's premises if different from the business address.

(d) Statement as to the type of business organization and of the persons interested in the business, supported by the items of information listed in §211.53.

(e) Statement of operations showing the estimated maximum quantity in gallons of specially denatured alcohol or specially denatured rum to be on hand, in transit, and unaccounted for at any one time and, in the case of users, a general statement as to the intended use to be made of the specially denatured alcohol or specially denatured rum, and whether recovery, restoration, and redenaturation processes will be used, and, if so, the estimated number of gallons of recovered denatured alcohol, recovered specially denatured rum, or recovered articles to be on hand at any one time.

(f) Listing of principal equipment to be used in manufacturing, packaging, and recovery processes, including processing tanks, storage tanks, bottling facilities, and equipment for the recovery, restoration (including the serial number, kind, capacity, name and address of owner, and intended use of distilling apparatus), and redenaturation of recovered denatured alcohol or specially denatured rum by users, and the size and complete description of the specially denatured alcohol or specially denatured rum storeroom or storage tanks.

(g) Trade names (see §211.52).

(h) List of the offices, the incumbents of which are authorized by the articles of incorporation, by laws, or the board of directors to act on behalf of the applicant or to sign his name.

(i) On specific request of the assistant regional commissioner, furnish a statement showing whether any of the persons whose names and addresses are required to be furnished under the provisions of §§211.53(a)(2) and 211.53(c) have (1) ever been convicted of a felony or misdemeanor under Federal or State law, (2) ever been arrested or charged with any violation of State or Federal law (convictions or arrests or charges for traffic violations need not be reported as to subparagraphs (1) and (2) of this paragraph, if such violations are not felonies), or (3) ever applied for, held, or been connected with a permit issued under Federal law to manufacture, distribute, sell, or use spirits or products containing alcohol or rum, whether or not for beverage use, or held any financial interest in any business covered by any such permit, and, if so, give the number and classification of such permit, the period of operation thereunder, and state in detail whether such permit was ever suspended, revoked, annulled, or otherwise terminated.

Where any of the information required by paragraphs (d) through (h) of this section is on file with the assistant regional commissioner, the applicant may, by incorporation by reference thereto, state that such information is made a part of the application for an industrial use permit. The applicant shall, when so required by the assistant regional commissioner, furnish as part of his application for an industrial use permit such additional information as may be necessary for the assistant regional commissioner to determine whether the applicant is entitled to the permit.

(72 Stat. 1370; 26 U.S.C. 5271)

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*Bonded dealer only

§211.53 Organizational documents.

The supporting information required by paragraph (d) of §211.43 includes, as applicable:

(a) *Corporate documents.* (1) Certified true copy of the certificate of incorporation, or certified true copy of certificate authorizing the corporation to operate in the State where the premises are located (if other than that in which incorporated).

(2) Certified list of names and addresses of officers and directors.

(3) Statement showing the number of shares of each class of stock or other evidence of ownership, authorized and outstanding, the par value thereof, and the voting rights of the respective owners or holders.

(b) *Articles of partnership.* True copy of the articles of partnership or association, if any, or certificate of partnership or association where required to be filed by any State, county, or municipality.

(c) *Statement of interest.* (1) Names and addresses of the 10 persons having the largest ownership or other interest in each of the classes of stock in the corporation, or other legal entity, and the nature and amount of the stockholding or other interest of each, whether such interest appears in the name of the interested party or in the name of another for him. If a corporation is wholly owned or controlled by another corporation, those persons of the parent corporation who meet the above standards are considered to be the persons interested in the business of the subsidiary and the names and addresses of such persons shall be submitted to the assistant regional commissioner on his specific request.

(2) In the case of an individual owner or partnership, name and address of every person interested in the business, whether such interest appears in the name of the interested party or in the name of another for him.

§211.54 Powers of attorney.

An applicant or permittee shall execute and file with the assistant regional commissioner a Form 1534, in accordance with the instructions on the form, for every person authorized to sign or to act on his behalf. (Not required for persons whose authority is furnished in accordance with §211.43 or §211.43a.)

[T.D. 7058, 35 FR 14396, Sept. 12, 1970]

§211.72 User's bond, Form 1480.

Every person filing an application on Form 1479 shall, before issuance of the industrial use permit, file bond, Form 1480, with the assistant regional commissioner, except that no bond will be required where the application is filed by a State, or any political subdivision thereof, or the District of Columbia, or where the quantity of specially denatured alcohol and specially denatured rum authorized to be withdrawn does not exceed 120 gallons per annum and the quantity which may be on hand, in transit, and unaccounted for at any one time does not exceed 12 gallons. The penal sum of the bond shall be computed on each gallon of specially denatured alcohol or rum, including recovered or restored denatured alcohol or specially denatured rum or recovered articles in the form of denatured spirits, authorized to be on hand, in transit to the premises of the user, and unaccounted for at any one time, at double the rate prescribed by law as the internal revenue tax on a proof gallon of distilled spirits: *Provided,* That the penal sums of bonds covering specially denatured alcohol Formulas No. 18 and No. 19 shall be computed on each gallon at the rate prescribed by law as the tax on a proof gallon of distilled spirits. The penal sum of any such bond (or the total of the penal sums where original and strengthening bonds are filed) shall not exceed $100,000 or be less than $500. No bond is required where application is filed on Form 4326, as provided in §211.42A.

(72 Stat. 1372; 26 U.S.C. 5272)
[T.D. 7058, 35 FR 14396, Sept. 12, 1970]

Subpart F—Premises and Equipment

§211.91 Premises

A permittee shall have premises suitable for the business being conducted and adequate for the protection of the revenue. When specially denatured spirits are to be stored, storage facilities shall be provided on the premises for such spirits received or recovered thereon. Except as otherwise provided in this section, these storage facilities shall consist of storerooms or stationary storage tanks (not necessarily in a room or building), or a combination thereof. A user receiving specially denatured spirits in tank cars or tank trucks and storing all such spirits therein, as provided in §211.168, need not provide stationary storage tanks. Where specially denatured spirits are to be received at or removed from a permittee's premises in bulk conveyances, suitable facilities for such operations shall be provided.

(72 Stat. 1372; 26 U.S.C. 5273)

Subpart G—Formulas and Processes

§211.101 General.

(a) *Form 1479-A.* Every person desiring to use specially denatured spirits for other than laboratory or mechanical purposes, as provided in §211.169, or to recover denatured spirits or articles, shall, except where previously approved formulas are adopted or as provided in §211.102, submit on Form 1479-A, directly to the Director, a description of each process or formula; a separate Form 1479-A shall be used for each such formula or process. In the case of articles to be manufactured with specially denatured spirits, quantitative formulas and processes shall be given. The preparation of Form 1479-A shall be in accordance with the headings and the instructions thereon.

(b) *Previously approved Forms 1479-A.* Any persons who intends to use previously approved formulas and processes, Forms 1479-A, on and after July 1, 1960, shall submit to the assistant regional commissioner a list, in quadruplicate, of all such approved Forms 1479-A which he intends to continue using. The list shall show, as to each Form 1479-A, the article or process in which denatured spirits are used or recovered, the formula of specially denatured spirits, the laboratory number of the sample (if any), the date of approval, and the code number prescribed for the article or process.

(72 Stat. 1369, 1372; 26 U.S.C. 5241, 5273)
[25 FR 5968, June 28, 1960, as amended by T.D. 7058, 35 FR 14397, Sept. 12, 1970]

§211.107 Samples of articles and ingredients.

In connection with the submission of Form 1479-A covering the proposed manufacture of an article (except a rubbing alcohol, a rubbing alcohol base, a proprietary solvent, or a special industrial solvent) containing specially denatured spirits, the applicant shall submit to the Director an 8-ounce sample of the article (except that a 4-ounce sample will be sufficient for a perfume which contains more than 6 ounces of perfume oils per gallon). For all toilet preparations containing specially denatured spirits, the applicant shall also submit a 1-ounce sample of the perfume oils (or of purchased mixtures consisting of perfume oils with other ingredients) to be used. The Director may at any time require the submission of samples of (a) any ingredients included in a formula, and (b) proprietary antifreeze solutions containing completely denatured alcohol.

(72 Stat. 1372; 26 U.S.C. 5273)
[37 FR 5751, Mar. 21, 1972]

Subpart H—Sale and Use of Completely Denatured Alcohol

§211.111 General

Completely denatured alcohol may be sold and used for any lawful purpose. Completely denatured alcohol may be used (a) in the manufacture of definite chemical substances where such alcohol is changed into some other chemical substance and does not appear in the finished product; (b) in the arts and industries (except in the manufacture of preparations or products for internal human use or consumption where any of such alcohol or of the denaturants used in such alcohol may remain in the finished product); and (c) for fuel, light, and power. Use of completely denatured alcohol in the arts and industries includes, but is not limited to, the manufacture of cleaning fluids, detergents, proprietary antifreeze solutions, thinners, lacquers, and brake fluids. Persons distributing and using (but not recovering for reuse) completely denatured alcohol are not required to obtain a permit or to file bond under this part. Persons recovering completely denatured alcohol for reuse shall procure an industrial use permit in accordance with Subpart D of this part and file bond in accordance with Subpart E of this part. Containers of products manufactued with completely denatured alcohol, such as proprietary antifreeze preparations, solvents, thinners, and lacquers, shall not be branded as completely denatured alcohol nor shall any such product be advertised, shipped, sold, or offered for sale as completely denatured alcohol.

(72 Stat. 1362, 1369, 1372; U.S.C. 5214, 5241, 5273)

Subpart J—Operations by Users of Specially Denatured Spirits

PROPRIETARY SOLVENTS

§211.170 Manufacture of proprietary solvents.

All articles coming under the general classification of proprietary solvents shall be manufactured with specially denatured alcohol Formula No. 1. The formulations shall be as follows, except as may otherwise be authorized by the Director:

(1) *Formulation No. I.*	*Gallons*
Specially denatured alcohol formula No. 1	100
Ethyl acetate	5
Gasoline or rubber hydrocarbon solvent.	
(2) *Formulation No. II.*	
Specially denatured alcohol formula No. 1	100
Denaturing grade wood alcohol	2
Ethyl acetate	1
Gasoline or rubber hydrocarbon carbon	1
(3) *Formulation No. III.*	
Specially denatured alcohol formula No. 1	100
Methyl isobutyl ketone	1
Ethyl acetate	1
Gasoline or rubber hydrocarbon solvent.	1
(4) *Formulation No. IV.*	
Specially denatured alcohol formula No. 1	100
Methyl isobutyl ketone	1
tert-butyl alcohol	2
Gasoline or rubber hydrocarbon solvent.	1
(5) *Formulation No. V.*	
Specially denatured alcohol formula No. 1	100
Methyl isobutyl ketone	1
Secondary butyl alcohol	2
Gasoline or rubber hydrocarbon solvent	1

§211.171 Sales by producers.

Proprietary solvents may be sold by producers to any person for use in manufacturing or as a solvent and to distributors and other persons for resale.

§211.172 Use in manufacturing.

When a proprietary solvent is used in the manufacture, for sale, of an article containing more than 25 percent of alcohol by volume, sufficient ingredients shall be added to definitely change the composition and character of the proprietary solvent. Such articles shall not be manufactured until a Form 1479-A covering production of the article has been submitted to and approved by the Director, except that Form 1479-A need not be submitted to cover the manufacture of surface coatings (including such products as inks) containing two pounds or more of solid coating material per gallon of such article. The formulation number (see §211.170) of the proprietary solvent to be used in manufacturing the article shall be stated in the Form 1479-A.

[T.D. 6715, 29 FR 3659, Mar. 24, 1964]

SPECIAL INDUSTRIAL SOLVENTS

§211.180 Manufacture.

Special industrial solvents shall be manufactured with specially denatured alcohol Formula No. 1 or 3-A. The formulations shall be as follows, except as may otherwise be authorized by the Director:

	Gallons
(1) *Formulation A.*	
Specially denatured alcohol Formula No. 1 or 3-A	100
Isopropyl alcohol or methyl alcohol	10
Methyl isobutyl ketone	1
(2) *Formulation B.*	
Specially denatured alcohol Formula No. 1 or 3-A	100
Isopropyl alcohol	5
Methyl isobutyl ketone	1
Methyl alcohol	5
(3) *Formulation C.*	
Specially denatured alcohol Formula No. 1 or 3-A	100
Methyl isobutyl ketone	1
(4) *Formulation D.*	
Ethyl acetate	5
Specially denatured alcohol Formula No. 1 or 3-A	100
Isopropyl alcohol or methyl alcohol	15
Methyl isobutyl ketone	1

[T.D. 6715, 29 FR 3659, Mar. 24, 1964]

§211.181 Sales by producers.

Special industrial solvents may be sold by producers to any person for use in manufacturing or as a solvent, and to wholeslae distributors and other producers of such solvents for resale. Sale of such solvents for distribution through retail channels is prohibited.

[T.D. 6715, 29 FR 3659, Mar. 24, 1964]

§211.182 Use in manufacuring articles for sale.

When a special industrial solvent is used in the manufacture of an article for sale, sufficient ingredients shall be added to definitely change the composition and character of the special industrial solvent; such an article shall not be manufactured until a Form 1479-A covering its production has been submitted to, and approved by, the Director. The formulation letter (see §211.180) of the special industrial solvent to be used shall be stated in the Form 1479-A. Special industrial solvents shall not be reprocessed into other solvents intended for sale where the other solvent would contain more than 50 percent alcohol by volume.

[37 FR 5752, Mar. 21, 1972]

SPECIFIC REGULATORY REQUIREMENTS

Applicable Excerpts From 27 CFR Part 212— Formulas for Denatured Alcohol and Rum

Subpart C—Completely Denatured Alcohol Formulas

§212.10 General.

Completely denatured alcohol will be denatured in accordance with formulas prescribed in this subpart. Producers of completely denatured alcohol may be authorized to add a small quantity of an odorant, rust inhibitor, or dye to completely denatured alcohol. Any such addition may be made only on approval by the Director. Request for such approval shall be submitted to the Director in triplicate. Odorants or perfume materials may be added to denaturants authorized for completely denatured alcohol in amounts not greater than 1 part to 250, by weight: *Provided,* That such addition shall not decrease the denaturing value nor change the chemical or physical constants beyond the limits of the specifications for these denaturants as prescribed in subpart E, except as to odor. Proprietors of distilled spirits plants using denaturants to which such odorants or perfume materials have been added shall inform the Director of the names and properties of the odorants or perfume materials so used.

[22 FR 1330, Mar. 5, 1957, as amended by T.D. 6474, 25 FR 5988, June 29, 1960]

§212.11 Formula No. 18.

To every 100 gallons of ethyl alcohol of not less than 160° proof add:

2.50 gallons of methyl isobutyl ketone;

0.125 gallon of pyronate or a compound similar thereto;

0.50 gallon of acetaldol (*b*-hydroxybutyraldehyde); and

1.00 gallon of either kerosene, deodorized kerosene, or gasoline.

[T.D. 6634, 28 FR 1038, Feb. 2, 1963]

§212.12 Formula No. 19

To every 100 gallons of ethyl alcohol of not less than 160° proof add:

4.0 gallons of methyl isobutyl ketone; and

1.0 gallon of either kerosene, deodorized kerosene, or gasoline.

[T.D. 6634, 28 FR 1038, Feb. 2, 1963]

Subpart D—Specially Denatured Spirits Formulas and Authorized Uses

§212.15 General.

(a) *Formulas.* Specially denatured alcohol shall be denatured in accordance with formulas prescribed in this subpart. Alcohol of not less than 185° of proof shall be used in the manufacture of all formulas of specially denatured alcohol, unless otherwise authorized by the Director. Rum for denaturation shall be of not less than 190° of proof and shall be denatured in accordance with Formula No. 4.

(b) *Uses.* Users and manufacturers holding approved Forms 1479-A covering manufacture of products or use in processes no longer authorized for a particular formula may continue such use. Subject to the provisions of Chapter 51 I.R.C., Part 211 of this chapter, and this part, the Director may authorize, in his discretion, the use of any formula of specially denatured alcohol or specially denatured rum for uses not specifically authorized in this part. The code number before each item under "authorized uses" shall be used in reporting the use of specially denatured alcohol or specially denatured rum.

[22 FR 1330, Mar. 5, 1957, as amended by T.D. 6474, 25 FR 5983, June 29, 1960; T.D. 6977, 33 FR 15708, Oct. 24, 1968]

§212.16 Formula No. 1

(a) *Formula.* To every 100 gallons of alcohol add:

Five gallons wood alcohol.

(b) *Authorized uses.* As a fuel:

611. Automobile and supplementary fuels.
612. Airplane and supplementary fuels.
613. Rocket and jet fuels.
620. Proprietary heating fuels.

§212.19 Formula No. 3-A.

(a) *Formula.* To every 100 gallons of alcohol add:

Five gallons methyl alcohol.

(b) *Authorized uses.* As a fuel:

611. Automobile and supplementary fuels.
612. Airplane and supplementary fuels.
613. Rocket and jet fuels.
620. Proprietary heating fuels.
630. Other fuel uses.

§212.38 Formula No. 28-A.

(a) *Formula.* To every 100 gallons of alcohol add:

One gallon of gasoline.

(b) *Authorized uses.* As a fuel:

611. Automobile and supplementary fuels.
612. Airplane and supplementary fuels.
613. Rocket and jet fuels.
620. Proprietary heating fuels.
630. Other fuel uses.

FORMS GENERALLY REQUIRED TO BE PREPARED

For Qualification of a Distilled Spirits Plant

ATF Form 3A	Indemnity Bond
ATF Form 1534 (5000.8)	Power of Attorney
ATF Form 1602	Consent
ATF Form 2601 (5110.56)	Distilled Spirits Bond
ATF Form 2603 (5110.25)	Application for Operating Permit Under 26 U.S.C. 517(b)
ATF Form 2607 (5110.41)	Registration of Distilled Spirits Plant
ATF Form 2625 (5000.9)	Personnel Questionnaire—Alcohol and Tobacco Products
ATF Form 4805 (1740.2)	Supplemental Information on Water Quality Considerations —Under 33 U.S.C. 1341(a)
ATF Form 4871 (1740.1)	Environmental Information
ATF Form 5100.1	Signing Authority for Corporate Officials

FORMS GENERALLY REQUIRED TO BE PREPARED

For Qualification of a Specially Denatured Alcohol User's Premises

ATF Form 1479 (5150.23)	Application for Permit to Use Specially Denatured Alcohol
ATF Form 1479-A (5150.19)	Formula for Article Made with Specially Denatured Alcohol or Rum
ATF Form 1480 (5150.20)	Bond of User of Specially Denatured Alcohol or Rum
ATF Form 1485 (5150.12)	Application and Withdrawal Permit of User to Procure Specially Denatured Alcohol
ATF Form 1534 (5000.8)	Power of Attorney
ATF Form 2625 (5000.9)	Personnel Questionnaire—Alcohol and Tobacco Products
ATF Form 4805 (1740.2)	Supplemental Information on Water Quality Considerations —Under 33 U.S.C. 1341(a)
ATF Form 4871 (1740.1)	Environmental Information
ATF Form 5100.1	Signing Authority for Corporate Officials

BATF REGIONAL OFFICES

Central Region
Indiana, Kentucky
Michigan, Ohio,
West Virginia

Regional Regulatory Administrator
Bureau of Alcohol, Tobacco, and Firearms
550 Main Street
Cincinnati, OH 45202
Phone (513) 684-3334

Mid-Atlantic Region
Delaware, District of
Columbia, Maryland,
New Jersey, Pennsylvania,
Virginia

Regional Regulatory Administrator
Bureau of Alcohol, Tobacco, and Firearms
2 Penn Center Plaza, Room 360
Philadelphia, PA 19102
Phone (215) 597-2248

Midwest Region
Illinois, Iowa, Kansas,
Minnesota, Missouri,
Nebraska, North Dakota,
South Dakota, Wisconsin

Regional Regulatory Administrator
Bureau of Alcohol, Tobacco, and Firearms
230 S. Dearborn Street, 15th Floor
Chicago, IL 60604
Phone (312) 353-3883

North-Atlantic Region
Connecticut, Maine,
Massachusetts, New Hampshire,
New York, Rhode Island,
Vermont, Puerto Rico,
Virgin Islands

Regional Regulatory Administrator
Bureau of Alcohol, Tobacco, and Firearms
6 World Trade Center, 6th Floor
(Mail: P.O. Box 15,
Church Street Station)
New York, NY 10008
Phone (212) 264-1095

Southeast Region
Alabama, Florida, Georgia,
Mississippi, North Carolina,
South Carolina, Tennessee

Regional Regulatory Administrator
Bureau of Alcohol, Tobacco, and Firearms
3835 Northeast Expressway
(Mail: P.O. Box 2994)
Atlanta, GA 30301
Phone (404) 455-2670

Southwest Region
Arkansas, Colorado,
Louisiana, New Mexico,
Oklahoma, Texas, Wyoming

Regional Regulatory Administrator
Bureau of Alcohol, Tobacco, and Firearms
Main Tower, Room 345
1200 Main Street
Dallas, TX 75202
Phone (214) 767-2285

Western Region
Alaska, Arizona,
California, Hawaii,
Idaho, Montana,
Nevada, Oregon,
Utah, Washington

Regional Regulatory Administrator
Bureau of Alcohol, Tobacco, and Firearms
525 Market Street, 34th Floor
San Francisco, CA 94105
Phone (415) 556-0226

APPENDIX A-2

Form No. 600 R4/82

APPLICATION FOR BENEFICIAL WATER USE PERMIT

(for groundwater of 100 gpm or more, and all surface water)

INSTRUCTIONS

Use one application for each source of supply or each development. Check all appropriate boxes and fill in each blank. If in your case any question is not applicable, enter NA (not applicable). If more space is needed, attach additional sheets.

A map must accompany this application as instructed under Item 12.

Complete the application and submit it with the appropriate filing fee to the Water Rights Bureau field office nearest you. Their locations are listed on the last page. The form will be returned if any of the pertinent information is incomplete.

FOR DEPARTMENT USE ONLY

Application No. __________

Date Rec'd. __________, 19____

Time __________ am/pm

Rec'd. By __________

Fee Rec'd. __________

Check No. __________

Transmittal No. __________

Refund __________

(Please type or print in ink)

1. **NAME OF APPLICANT** ______________________________

Mailing Address ______________________________

City or Town ______________ State ______________ Zip ______________

Home Phone ______________ Other Phone ______________

2. **Source of Water Supply:** Check and/or complete one source below.

☐ Well

☐ Lake Name ______________ Tributary to ______________

☐ Stream Name ______________ ☐ Unnamed Source
Tributary to ______________

☐ Spring Name, if any ______________
Tributary to ______________

☐ Closed Basin (A closed basin results when water drains into a depression, lake, etc. from which water escapes only by evaporation.)

3. **Point of Diversion** (Describe the location down to the nearest 10 acres):

_____¼ _____¼ _____¼ Section_____, Township_____N/S, Range_____E/W, ______________County.
(and when applicable)
Government Lot_____, or Lot_____, Block_____, Subdivision Name ______________

Additional Point of Diversion: (Also use item 13, Remarks, for additional points of diversion):

_____¼ _____¼ _____¼ Section_____, Township_____N/S, Range_____E/W, ______________County
(and when applicable)
Government Lot_____, or Lot_____, Block_____, Subdivision Name ______________

MONTANA DEPARTMENT OF NATURAL RESOURCES & CONSERVATION DNRC

32 SOUTH EWING *HELENA, MONTANA 59620* *449-3962*

The water will be discharged to same source, if not consumed.

☐ Yes ☐ No If no, explain and give the complete land description at the point of discharge.

____

____

______¼______¼______¼ Section______, Township______N/S, Range______E/W, ______________County,

(and when applicable)

Government Lot______, or Lot______, Block______, Subdivision Name ______________________

4. **Means of Diversion**

☐ Pump

__________Rated Capacity (gpm, ghp, cfs)

__________Horsepower

__________Lift (in feet)

☐ Well:______________Depth (in feet)

☐ Developed Spring

☐ Dikes

☐ Headgate/Ditch or Pipeline

If other, describe: ____

____

5. **Reservoir** (impoundment by dam or pit). See formulas below for computing volume.

a. Capacity of existing (old) reservoir ______________________acre-feet.
b. Capacity of proposed (new) reservoir or enlarged reservoir ______________________acre-feet.
c. Would a permanent drainage device be installed? ______________Yes ______________No
d. Reservoir will be located off-stream (away from source) ______________Yes ______________No
If yes, give location: ______¼______¼______¼ Section______, Township______N/S,
Range______E/W, ______________________________County

Total volume of pit______________________ Compute as follows:

Surface area _______ (acres) × maximum depth _______ (feet) × 0.5 = __________ (volume) acre-feet.

Total volume of reservoir______________________ Compute as follows:

Surface area _______ (acres) × 0.4 × maximum depth in feet at dam _______ = _______ (volume) acre feet.

6. **Period of Appropriation:** __________ (month/day) to __________ (month/day) inclusive each year.
(The period during the year when the water will be diverted, impounded or withdrawn from the source of supply.)

7. **Description of Proposed Beneficial Uses:**

Stock: Estimated maximum number and type of livestock ______________________________

____

Domestic: Number of families to be supplied ______________________________

Other (Describe) ____

____

Irrigation

a. Method of Irrigation

☐ Sprinkler ☐ Spreader Dike ☐ Border Dike

☐ Contour Ditch Other (Describe) ______________________________

b. Type of crops to be grown: ____________________

c. Number of irrigations per season: ____________________

d. If the purpose of this appropriation is to provide additional water to lands which are already irrigated, then the acreage that receives the additional water is considered **supplemental.** If this application involves supplemental irrigation indicate the basis of the **existing water** right that is being supplemented.
Claim No. __________ Permit No. __________ Certificate No. __________
Other ____________________

8. **Place of Use**

Irrigation: List the acreages to be irrigated and their location by legal land desription. Also indicate in the extreme right-hand column the number of acres to be receiving additional water with an "S" for supplemental, and the acres to be irrigated for the first time with an "N" for new.

County __________ Subdivision Name __________ New (N) or Supplemental (S)

____ Acres, Lot ____ Block ____, ____ ¼ ____ ¼ ____ ¼ Section ____, T ____ N/S, R ____ E/W ____
____ Acres, Lot ____ Block ____, ____ ¼ ____ ¼ ____ ¼ Section ____, T ____ N/S, R ____ E/W ____
____ Acres, Lot ____ Block ____, ____ ¼ ____ ¼ ____ ¼ Section ____, T ____ N/S, R ____ E/W ____
____ Acres, Lot ____ Block ____, ____ ¼ ____ ¼ ____ ¼ Section ____, T ____ N/S, R ____ E/W ____
____ Acres, Lot ____ Block ____, ____ ¼ ____ ¼ ____ ¼ Section ____, T ____ N/S, R ____ E/W ____
____ Acres, Lot ____ Block ____, ____ ¼ ____ ¼ ____ ¼ Section ____, T ____ N/S, R ____ E/W ____
____ Acres, Lot ____ Block ____, ____ ¼ ____ ¼ ____ ¼ Section ____, T ____ N/S, R ____ E/W ____
____ Acres, Lot ____ Block ____, ____ ¼ ____ ¼ ____ ¼ Section ____, T ____ N/S, R ____ E/W ____
____ Acres, Lot ____ Block ____, ____ ¼ ____ ¼ ____ ¼ Section ____, T ____ N/S, R ____ E/W ____
____ Acres, Lot ____ Block ____, ____ ¼ ____ ¼ ____ ¼ Section ____, T ____ N/S, R ____ E/W ____

Nonirrigation: If the place of use of the water will be the same as point of diversion (Item 3). check ☐. If not, give the location of use:

____ ¼ ____ ¼ ____ ¼ Section ____, Township ____ N/S, Range ____ E/W, __________ County.
(and when applicable)
Government Lot ____, or Lot ____, Block ____, Subdivision Name __________

9. **Amount of water, use to which it will be applied** (irrigation, stock, domestic, other) **and period of use:**

________ cfs / gpm up to ________ acre-feet for ________ use from ________ (mo./day) to ________ (mo./day)
________ cfs / gpm up to ________ acre-feet for ________ use from ________ (mo./day) to ________ (mo./day)
________ cfs / gpm up to ________ acre-feet for ________ use from ________ (mo./day) to ________ (mo./day)

Total amount requested ________ cfs / gpm up to ________ acre-feet per year.

10. **Proposed Construction:**

What is the amount of time needed to complete the development after permit is received? (Note: Construction should not begin until permit is received.)
____

11. **Ownership:**

a. Property owner at the point of diversion ____________________

b. Property owner at the place of use ____________________

c. If you are not the owner at (a) or (b) above, it is your responsibility to obtain the necessary easements and right-of-way. If state or federal lands are involved, contact the appropriate agency since the water right may need to be applied for by them.

12. **Location Map:**

A map showing the following items **must accompany this application. Failure to supply an accurate map constitutes an incomplete application and the appliction will be returned for completion. An ASCS aerial photo or USGS topographic map may be used.**

Items to be shown on the map:

a. Township and range numbers
b. Section corners and number.
c. Point of diversion
d. Location of conveyance ditch, pipeline etc.
e. Place of use (irrigated acres: new and supplemental, location of stock tanks)
f. Applicant's signature or name of person preparing map

13. **Remarks:** Provide any additional information that would help in explaining the proposed appropriation.

14. **The applicant certifies that the statements appearing here are to the best of his/her knowledge true and correct.**

Signature Date

Signature Date

SUBMIT THE COMPLETED APPLICATION AND PROPER FILING FEE TO THE APPROPRIATE FIELD OFFICE NEAREST YOU. FIELD OFFICES ARE LOCATED IN: HELENA, MISSOULA, KALISPELL, HAVRE, GLASGOW, MILES CITY, BILLINGS, LEWISTOWN AND BOZEMAN. (Check your local telephone directory for addresses and telephone numbers.)

FEE SCHEDULE

A) Fee charge based on the following rate schedule: For consumptive uses:

0 - less than 25 acre-feet per year	$ 50
25 - less than 100 acre-feet per year	$100
100 - less than 500 acre-feet per year	$150
500 - less than 1,000 acre-feet per year	$200
1,000 - or more acre-feet per year	$250

B) For Applications for non-consumptive uses: Fee charge based on following rate schedule:

0 - less than 1,000 acre-feet per year	$ 50
1,000 - less than 10,000 acre-feet per year	$100
10,000 - or more acre-feet per year	$200

For any Application with a combination of consumptive and non-consumptive uses the rate schedule shown in (A) above shall apply.

C) For any request for an Interim Permit to drill and test only; there shall be a fee of $10.00 in addition to the rate schedules shown in (A) or (B) above.

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